plating

Best Wishes
AMERICAN

DECEMBER • 1957

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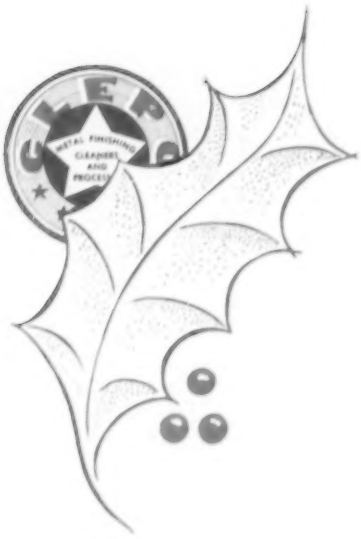


GREETINGS

Again we greet you at
This Holiday Season
To you whose friendship
And Good-Will we cherish may
We say thank you and also
Wish you a real Merry Xmas
And a bright and successful
New Year

FREDERICK GUMM
Chemical Company Inc.
538 FOREST STREET, KEARNY, N.J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1200.

ENTHONE

Which metal do you want to strip?

There's an Enthone metal stripper for most applications:

☐ **ENSTRIP "S"** — an additive for sodium cyanide solutions used to dissolve nickel, copper, gold, silver, zinc, cadmium and alloys of these metals from steel without attacking the base metal in any way.

☐ **ENSTRIP "A"** — a fully-prepared alkaline mixture already containing sodium cyanide, used for the same purpose as Enstrip "S".

☐ **ENSTRIP "Z"** — an alkaline stripper that rapidly strips zinc from steel.

☐ **ENSTRIP 103** — an economical, alkaline electrolytic stripper for removing nickel, copper, brass, zinc, silver, gold, cadmium, tin and lead from steel.

☐ **ENSTRIP CR-5** — a rapid, acid-type dry salt stripper that dissolves heavy deposits of chromium from steel, nickel, copper base alloys, stainless steel and aluminum.

☐ **ENSTRIP "T-L"** — a fast-acting, dry alkaline stripper for dissolving tin, lead, solder alloys, tin-zinc alloys and zinc from steel base metals.

☐ **ENSTRIP 165S** — a neutral dry-additive for acid solutions for quick removal of nickel, tin, lead, zinc, cadmium, iron and aluminum from copper and copper base alloys.

☐ **ENSTRIP L-88** — a completely prepared acid electrolytic stripper for removing copper, nickel, chromium, brass, bronze, iron and white brass from zinc-base die castings.

These eight outstanding strippers are "stock" items in the Enthone line of chemicals for the metal finishing and electroplating industries. In most cases, one of the "Enstrips" will prove to be the answer to your problem. On the other hand, special developments are available from Enthone to meet requirements not covered by the Enstrips featured above. Write us, outlining your needs, and include a sample of your product, if possible. We'll be glad to recommend the best stripping method possible.

Write to Dept. P-12

DISTRIBUTION AND SERVICE THROUGHOUT THE UNITED STATES, CANADA, MEXICO, BRAZIL AND EUROPE

PRODUCTS OF Enthone THE SCIENTIFIC SOLUTION OF METAL FINISHING PROBLEMS

ENTHONE

ENTHONE
INCORPORATED
442 ELM STREET, NEW HAVEN 11, CONN.
Metal Finishing Processes • Electroplating Chemicals

SUBSIDIARY OF AMERICAN SMELTING AND REFINING COMPANY

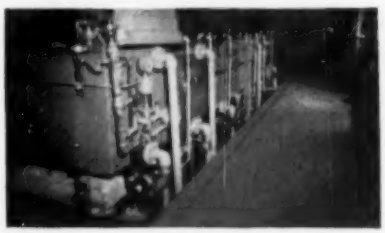
Completely automatic, unattended unloading end of the Stevens Automatic Barrel showing control panel and rectifier site located above machine.

Unistrut says— "COSTS 50% LOWER— FINISH BETTER with . . . STEVENS AUTOMATIC BARREL MACHINE"

Every day in the Unistrut Corporation plant, Wayne, Michigan, thousands of small parts are zinc plated and shipped to Unistrut warehouses throughout the United States. All of these parts are zinc plated automatically by a Stevens Automatic Barrel Machine.

Unistrut high standards require a uniformity of plate on the parts used in their metal framing systems. But since installing the Stevens Automatic Barrel they have reported other advantages as well—"less handling, smaller inventories and quicker shipments." When you consider the 50% cost savings of actual plated parts too, it all adds up to a terrifically profitable investment.

Why don't you tell us your metal finishing problems and let us make recommendations. There's no obligation.



Side view of machine showing excellent drainage system.

Plating section of machine with ventilating duct work.

Write today for your copy of the 1957 bulletin, "The Modern Concept . . . Stevens Automatic Barrel Processing and Plating Machine." Write to Frederic B. Stevens, Inc., 1800—18th Street, Detroit 16, Michigan.

STEVENS 75 YEARS OF SERVICE

FREDERIC B. STEVENS INCORPORATED

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DETROIT 16, MICHIGAN

An Educational Society for the Advancement of the Science of Electroplating, the Finishing of Metals and Allied Arts

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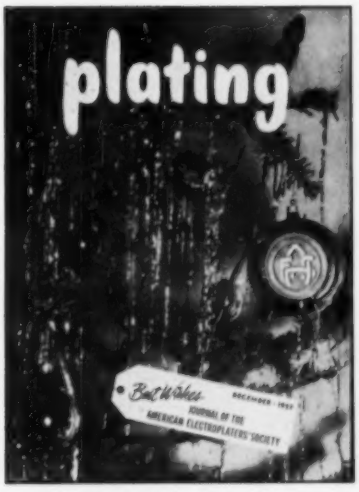

Cover Designed by James A. Civille.

plating

Journal of the American Electroplaters' Society

December 1957 — **Vol. 44, No. 12**

EDITORIAL:

This Message to You at Christmastime 1263

Electroforming of Linear Accelerator Structures 1291
by James A. Pope

Studies on Electroless Nickel Plating 1297
by Dr. Clara H. de Minjer and Dr. Abner Brenner

Increased Production at Lower Cost Through Automation 1306

45th Annual Convention Plans Forging Forward 1308

American Society of Testing Materials, Committee B-8, Semi-Annual Meeting 1318
Summary by Dr. Edward B. Saubestre

Mohawk Valley Installed as AES's 57th Branch 1334

AES Branch Directory 1354
AES Directory 1356
AES Membership Report 1354
AES News 1310
Article References 1328
Books 1339
Branch News 1336
Classified Advertisements 1355
Equipment and Supplies 1330
Future Meetings 1356
Industry News 1320
Industry News Briefs 1324
Index to Advertisers 1358
Interim Meeting 1285
Intersociety News 1312
Patent Abstracts 1314
Personals 1336
Trade Literature 1327

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YOU SAVE WORK AND TIME!

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Lead Fluoborate Solution
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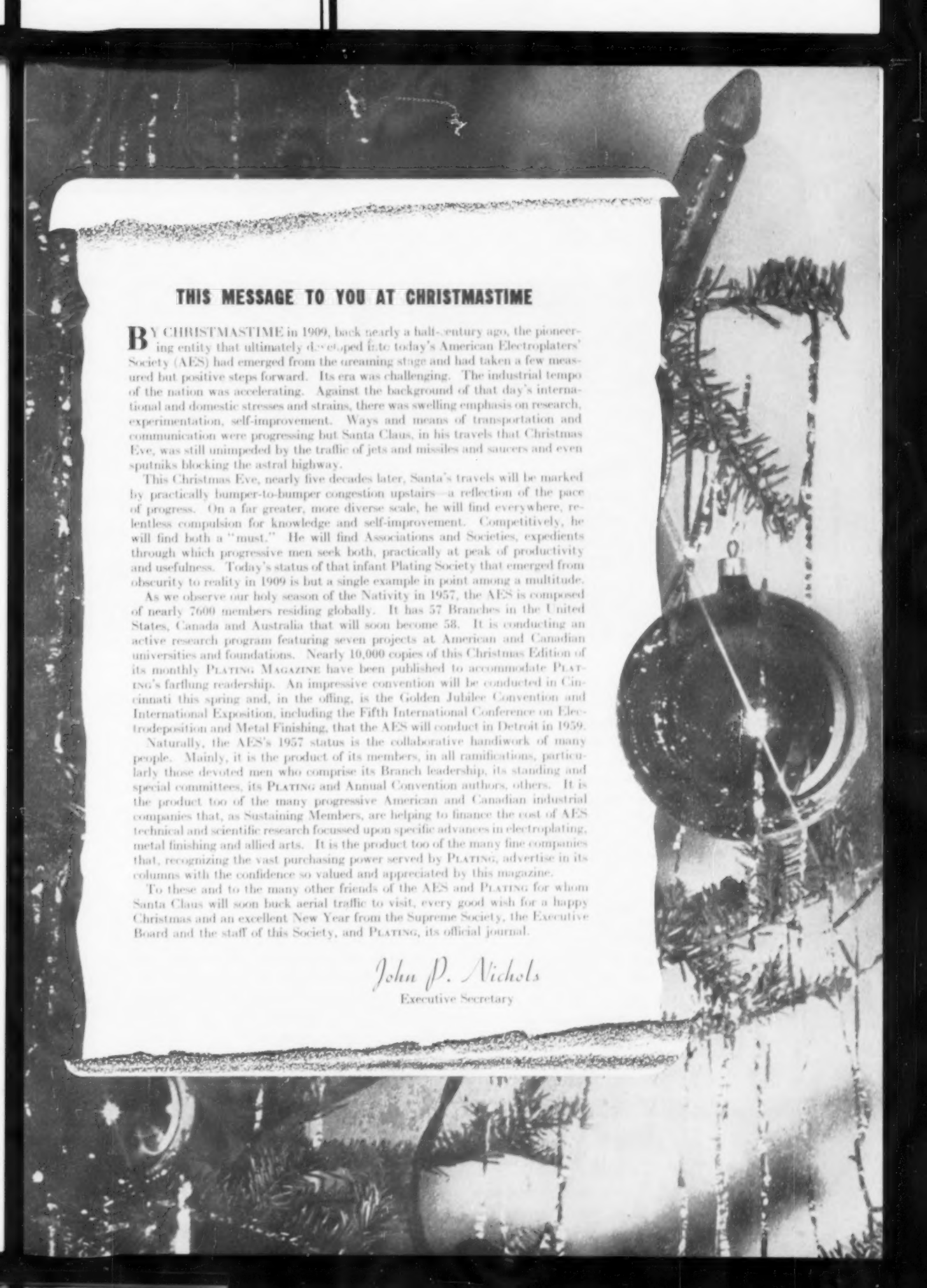


THIS MESSAGE TO YOU AT CHRISTMASTIME

BY CHRISTMASTIME in 1909, back nearly a half-century ago, the pioneering entity that ultimately developed into today's American Electroplaters' Society (AES) had emerged from the dreaming stage and had taken a few measured but positive steps forward. Its era was challenging. The industrial tempo of the nation was accelerating. Against the background of that day's international and domestic stresses and strains, there was swelling emphasis on research, experimentation, self-improvement. Ways and means of transportation and communication were progressing but Santa Claus, in his travels that Christmas Eve, was still unimpeded by the traffic of jets and missiles and saucers and even sputniks blocking the astral highway.

This Christmas Eve, nearly five decades later, Santa's travels will be marked by practically bumper-to-bumper congestion upstairs—a reflection of the pace of progress. On a far greater, more diverse scale, he will find everywhere, relentless compulsion for knowledge and self-improvement. Competitively, he will find both a "must." He will find Associations and Societies, expedients through which progressive men seek both, practically at peak of productivity and usefulness. Today's status of that infant Plating Society that emerged from obscurity to reality in 1909 is but a single example in point among a multitude.

As we observe our holy season of the Nativity in 1957, the AES is composed of nearly 7600 members residing globally. It has 57 Branches in the United States, Canada and Australia that will soon become 58. It is conducting an active research program featuring seven projects at American and Canadian universities and foundations. Nearly 10,000 copies of this Christmas Edition of its monthly PLATING MAGAZINE have been published to accommodate PLATING's farflung readership. An impressive convention will be conducted in Cincinnati this spring and, in the offing, is the Golden Jubilee Convention and International Exposition, including the Fifth International Conference on Electrodeposition and Metal Finishing, that the AES will conduct in Detroit in 1959.

Naturally, the AES's 1957 status is the collaborative handiwork of many people. Mainly, it is the product of its members, in all ramifications, particularly those devoted men who comprise its Branch leadership, its standing and special committees, its PLATING and Annual Convention authors, others. It is the product too of the many progressive American and Canadian industrial companies that, as Sustaining Members, are helping to finance the cost of AES technical and scientific research focussed upon specific advances in electroplating, metal finishing and allied arts. It is the product too of the many fine companies that, recognizing the vast purchasing power served by PLATING, advertise in its columns with the confidence so valued and appreciated by this magazine.

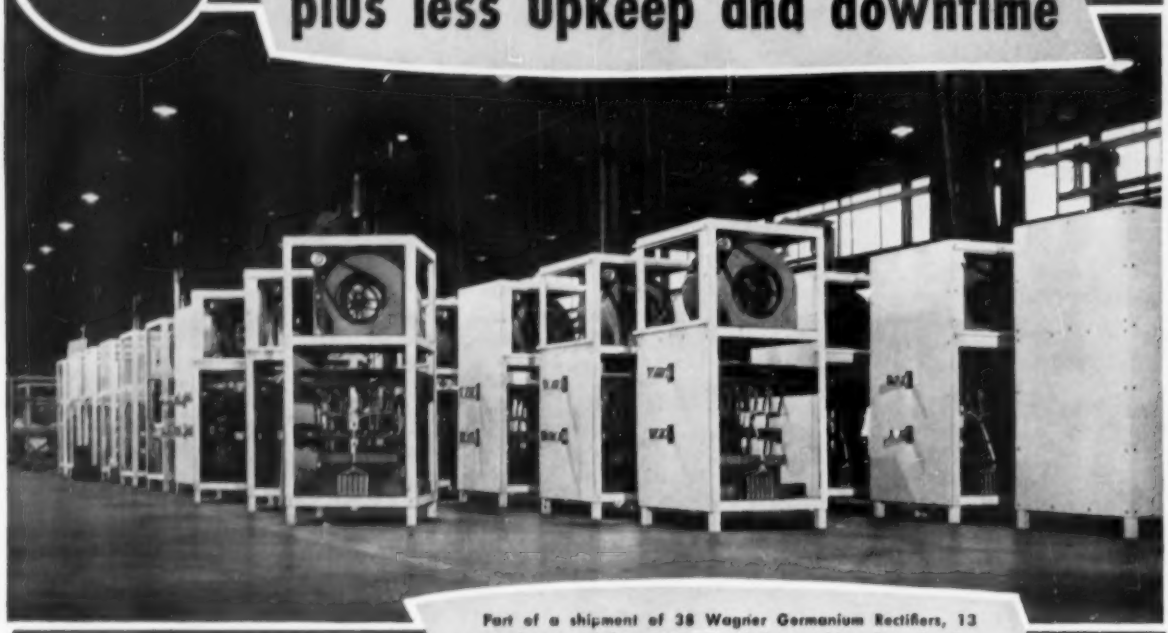
To these and to the many other friends of the AES and PLATING for whom Santa Claus will soon buck aerial traffic to visit, every good wish for a happy Christmas and an excellent New Year from the Supreme Society, the Executive Board and the staff of this Society, and PLATING, its official journal.

John P. Nichols

Executive Secretary

Daily savings with Wagner Rectifiers...

plus less upkeep and downtime



Part of a shipment of 38 Wagner Germanium Rectifiers, 13 regulators and three automatic plating machines for a leading business machine manufacturer.

Just what does the higher efficiency of Wagner Selenium Electroplating Rectifiers mean to *you?* Of interest to management-minded men is the day to day *decrease* in the use of AC current—and in most plating shops that is a big item. *Why* less current? Because the comparatively greater stack area for a similar *rating* (up to 40% more rectification area) results in lower temperature rise, hence more DC power delivered to your tank for the AC input.

Then there are even greater but less predictable savings. The conservative ratings of Wagner Rectifiers due to the ample stack areas mean longer stack life (less chance of burn-outs) and ample capacity for overloads. You virtually eliminate interruptions for maintenance with the resultant idle labor and loss of production, not to mention the cost of replacing stacks. Wagner transformers, too, are specially designed for electroplating applications; they are provided with Class B non-flammable insulation (glass, mica, asbestos, etc.) for safety and extra long service life. Cooling fans are standard, easily replaced in minutes, and in the event of a ventilating failure, the rectifier may be operated without exceeding the maximum safe operating temperature; Wagner Rectifiers do not reach this point until subjected to an overload of 500% of normal rating.

Cost-minded? Weigh these day by day savings, plus the greatly reduced maintenance costs of Wagner Rectifiers—*plus* the *safety* features which extend the life of this valuable equipment—and call the Wagner man in your area. If you have an electroplating problem—or a parts handling problem before or after plating—lay it in his lap and we'll pitch in to work out a solution. Remember, Wagner Brothers is your *one* source for anodes, chemicals, rectifiers, automatic and semi-automatic equipment, all manufactured by one company.

MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

400 MIDLAND AVE., DETROIT 3, MICHIGAN

CHICAGO • CINCINNATI • CLEVELAND • INDIANAPOLIS • NEW YORK • SYRACUSE • GRAND RAPIDS

Wagner BROTHERS INC.

HOW WAGNER SERVICE CUT PLATING COSTS 20%

Fred Janke (right), Works Manager, to Angelo Comito, Superintendent of Hancock Mfg. Co., Jackson, Michigan: "A major saving in our plating department is the elimination of maintenance of rectifiers. Wagner's suggestion has stopped corrosion and stock replacements."

You've heard manufacturers of industrial equipment talk of their "service"—but all too often service is indefinite, and as time proves, of little real benefit to you. But *some* service is effective and Wagner Brothers' service comprises a good part of the commodity you buy.

For example, when Hancock Manufacturing Company asked several plating equipment manufacturers to submit suggestions for improving the efficiency of their zinc plating department, Wagner Brothers jumped at the chance to demonstrate the real meaning of "service". No other vendor saw room for improvement — but Wagner Brothers' representatives analyzed Hancock's problems and came up with answers which have paid off in the most tangible ways — in better plating, reduced maintenance, more production from the existing automatics and competitive pricing. Here's how:

- Rectifiers were changed from individual 1500 amp. units to 5000 and 6000 amp. Wagner selenium cubicles installed in an adjacent room with control panels in the plating room.
- Solutions were replaced with Wagner proprietaries.
- All buss bars were replaced with buss of greater capacity to increase the productivity of the automatics.
- Racks were redesigned, principally with larger hooks for better handling of internal auto hardware—locks, hinges, window regulators, etc.
- New grease traps were installed to reduce contamination of solutions.
- Checks are made frequently and regularly by Wagner technical men and sales representatives to insure proper balance of solutions.

The changes described above have resulted in improved quality and a complete elimination of Hancock's great problem, the continuous replacement of rectifier stacks. As other problems arise, they are immediately tackled by the Wagner men who check the operation on an average of once a month to cut losses at the source.

So there's the Wagner meaning of "service". Why not call our representative in your area so that you, too, may see Service in Action.

MANUFACTURERS AND PROCESSORS OF ALL METAL-FINISHING CHEMICALS, ANODES, AND EQUIPMENT

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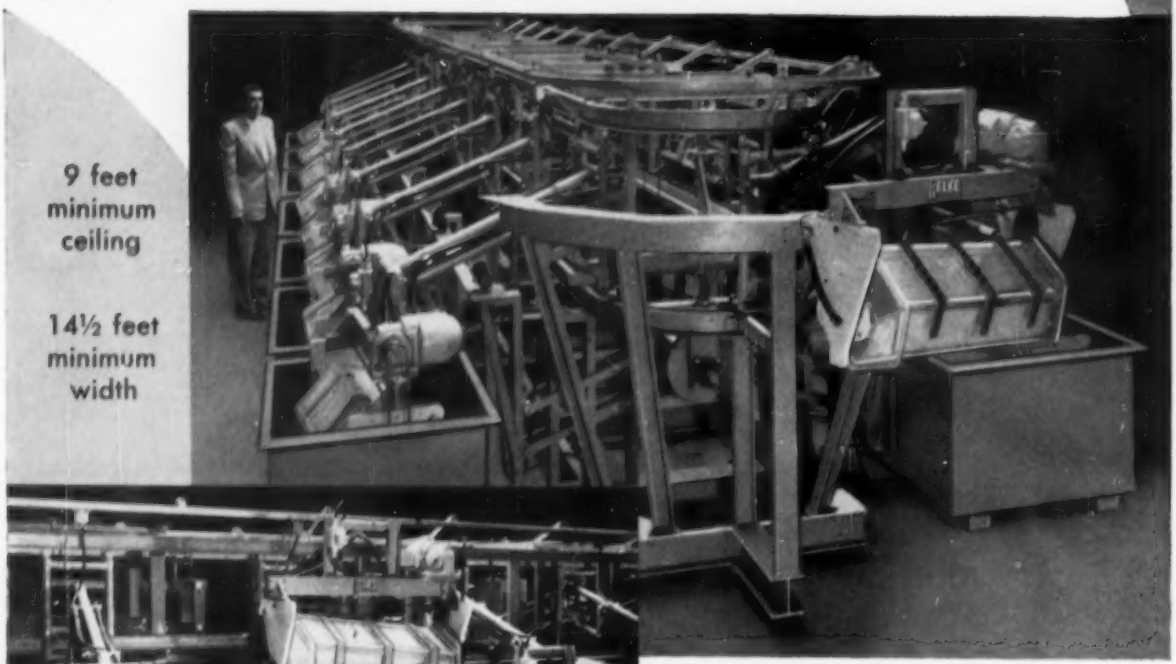
Wagner BROTHERS INC.

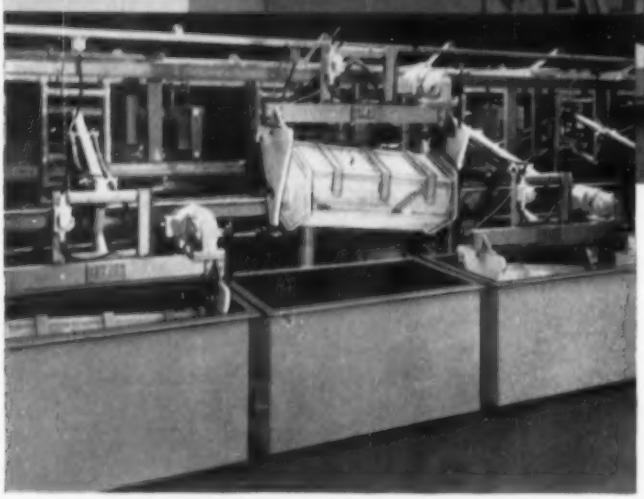
New Automatic Barrel Plater

Loaded with money-making FIRSTS

9 feet minimum ceiling

14½ feet minimum width





Partial view of rinse tanks. The elevated cylinder in the center is at a delayed set down station used for bright dip, chromate coatings and other processes that require short submersion periods. Delayed set down timing is adjustable to give the required submersion time or to skip the tank. Any number of delayed set down stations can be furnished at desired locations.

SIMPLE CYLINDER MOUNTING. The hanger bridge of the cylinder is bolted to the hanger arm of the machine. Cylinders are easily and quickly changed when larger or smaller perforations are required or for any reason. Cylinders of different sizes and types may be used. Present cylinders, when made of materials suitable for full cycle operation, can be converted for use with the BELKE Automatic.

Uniformity of cleaning and electroplating deposit never before approached and new low plating costs.

Continuous automatic operation. Solves skilled help problems, eliminates trouble and waste caused by human error, and puts out a big volume flow of first quality work.

Lowest Maintenance. Simple electro-mechanical operation that keeps working under plating room conditions Easily adjusted and maintained by plant personnel.

Lowest upkeep. Made of **STANDARD** parts that have been selected for long service, yet are readily obtained and easily replaced by any mechanic.

Small floor space – minimum width, 14½ feet. Length varies with number of barrel stations.

Low head room – minimum ceiling, 9 feet.

A few of many other special advantages:

BELKE Double Oscillating Cylinders at no extra charge.

Hanger arms permit mounting present cylinders or other cylinders of different sizes.

Separately timed delayed set down and skip stations as required.

Low initial cost. Ask your BELKE Service Engineer or write for particulars.

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51
EVERYTHING FOR PLATING PLANTS

BALANCED QUALITY *

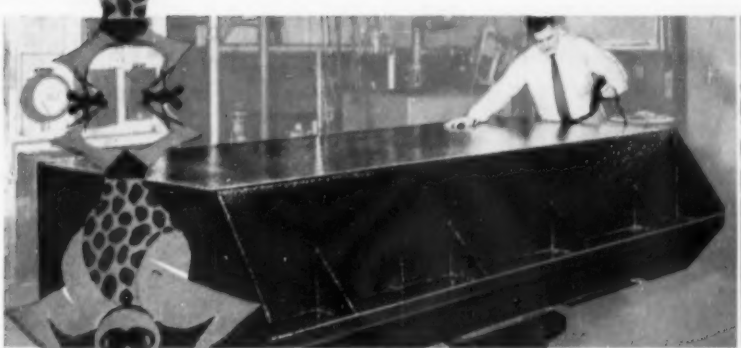
Keeps **MICCROSOL** on top

Developed originally as a coating for plating racks, Miccrosol E-1003 has all the desirable characteristics which make it an ideal coating for many other applications.

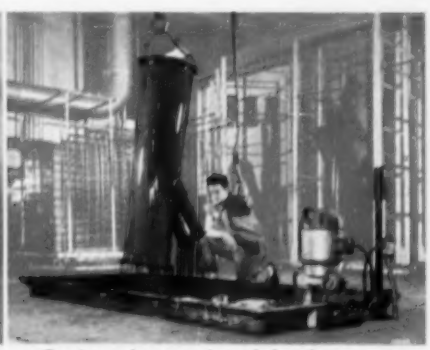
The chemical resistance of Miccrosol is unequalled in its field. Its toughness, abrasion resistance, resilience, and flexibility are unsurpassed. It's easy to apply in either a *dip* or *spray* formula. When necessary, it's easy to repair.

Year after year we build this quality into Miccrosol, improving it whenever possible and practicing every economy in its manufacture that does not compromise the excellence of the product.

This BALANCED QUALITY enables you to use Miccrosol *profitably* while assuring your customers of coating jobs that will prove superior in their performance.



Spark testing a large plating tank coated with Miccrosol Spray S-2003.



Coating a large section of duct by dipping in Miccrosol E-1003.

*Outstanding performance and value

MICHIGAN CHROME *and Chemical Company*

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Developed and manufactured by experienced platers and coaters

FOR TANKS, DUCTS, AND OTHER EQUIPMENT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1206.

Special Reports On Finishing Non-Ferrous Metals

NUMBER II—Paint Base, Corrosion-Resistant Finishing with Iridite

WHAT IS IRIDITE®?

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a non-porous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

Chromate conversion coatings are well known and accepted throughout industry as an economical means of providing corrosion protection, a good paint base and decorative finishes for non-ferrous metals. However, continued developments have been so rapid and widespread that many manufacturers may not be completely aware of the breadth of application of this type of finish. Hence, this digest of current information; to bring you up to date on the many ways in which you can obtain proper surface preparation for painting and increase product durability with a single multi-purpose chemical pretreatment. Report I on decorative, corrosion-resistant finishes and Report III on chemically polished, corrosion-resistant finishes are available on request.

First, it is an accepted fact that metal surfaces should be prepared before painting to make possible an efficient paint system. Naturally, this preparation should provide for good initial paint adhesion. Chemical treatments have proved extremely effective in this respect, particularly those of a neutral or preferably acid nature. Further, to be most efficient, chemical treatments should provide a non-porous barrier to maintain adhesion by sealing the metal from the paint and moisture. They should also provide a self-healing film which prevents lateral corrosion in the event that bare metal is exposed through scratching.

The Iridite chromate conversion coatings meet all these requirements. Iridite is a chemical conversion treatment for surface preparation. It provides initial paint bonding by molecular adhesion. It is acid in nature and produces a film that is gel-like and non-porous in structure. Thus, the Iridite film effectively seals the metal from the paint and from moisture penetration. Because the film contains certain relatively soluble constituents, it will protect areas scratched through to bare metal and prevent lateral corrosion. This is accomplished by a gradual leaching of these constituents into the damaged area.

Further, because of its gel-like, non-crystalline nature, the Iridite film will not affect the appearance or texture of the paint film, nor will it dust or powder to mar the painted surface. Because the film is non-porous, paint coverage is increased, thus substantial savings in paint costs will be realized. In addition, treated parts may be stored for long periods of time prior to painting without the risk of entrapped moisture causing blistering when painting.

Iridite chromate conversion coatings are widely used with equal ease and success under both baked and air-dried paint systems. While the actual adherence properties of the Iridite film do not increase appreciably with its thickness, corrosion protection does. The protection of the Iridite film is proportionate to its thickness and should be taken into consideration when selecting the Iridite to meet your needs. However, it is sometimes necessary to sacrifice maximum corrosion protection for appearance when a finished part is to be only partially painted. For example, it may be desirable to use a thin, clear, bright Iridite film if the unpainted areas must present a chrome-like appearance. A typical case is that of instrument housings on which the exterior is painted and the inside left unpainted.

On the other hand, if all surfaces of the product are to be painted and maximum corrosion protection is required, the heavier and most protective Iridite films should be used. For example, all surfaces of zinc die cast fruit juicers are finished with a highly protective Iridite film prior to painting to provide maximum resistance to the corrosive action of fruit juices.

Iridite finishes are now available for all commercial forms of the more commonly used non-ferrous metals, including zinc, cadmium, aluminum, magnesium, silver, copper, brass and bronze. In addition to providing an excellent base for paint, the Iridite films also have high decorative value when used as final finishes in themselves.

These films can produce a wide variety of pleasing appearances including clear bright, iridescent yellow, bronze, olive drab and brown. In addition, many films can be modified by bleaching or by dyeing. Among the dye colors available are various shades of red, yellow, green, blue or black.

In planning or designing, you should consider the many other characteristics of Iridite finishes which may enter into the specific problem. In addition to their functions as protective and decorative finishes, and as bases for organic finishes and bonding compounds, Iridites have low electrical resistance. Some can be soldered and welded. The film does not affect the dimensional stability of close tolerance parts.

Iridites are widely approved under both Armed Services and industrial specifications because of performance, low cost and savings of materials and equipment.

You can see then, that with the many factors to be considered, selection of the Iridite best suited to your product requires the services of a specialist. That's why Allied maintains a staff of competent Field Engineers—to help you select the Iridite to make your installation most efficient in improving the quality of your product. You'll find your Allied Field Engineer listed under "Plating Supplies" in your classified telephone book. Or, write direct and tell us your problem. Complete literature and data, as well as sample part processing, is available. Allied Research Products, Inc., 4004-06 East Monument Street, Baltimore 5, Maryland.

A Timely Message on

"Finer Products Through Imagination"

by Ben P. Sax

Chairman of the Board, *American Buff Company*

This slogan on the building of a nationally known manufacturer exemplifies for me the spark which ignites the spirit of progress.

IMAGINATION is the creative ability to think of familiar objects, ideas, methods and words from a new standpoint . . . the ingenious adaptation of known elements to new or as yet unrelated applications. The familiar advantages that today we take for granted, just yesterday were "pictures in the mind", often entirely fanciful in their early stages. Yet *they* now offer comparable opportunity for improvement through new imaginative development.

In our own and thousands of other industries, mechanizing some manual action for faster, lower-cost, better-quality production is a constant "mind picture". Countless ingenious adaptations of basic ideas (the wheel, the motor, the connecting element) are pure imagination . . . the "yeast" that makes "dough" in all types of industrial production.

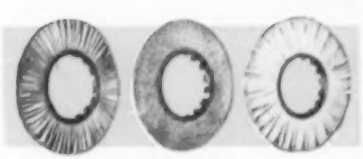
Imagination is a part of every manufacturer's stake in the future. Nurturing this talent, creating an ideal "climate" for imaginative genius, pays off for everybody. It is a way of life with us at American Buff. Our newest mechanization for the metal finishing industry is the "impossible" automation of hand-finishing operations. Our new Uniflex Abrasive Polishing Wheel is a current example of product improvement symbolic of the potential which always exists.

We salute The Bell & Howell Company for its slogan, "Finer Products Through Imagination", symbol of American Industry.

Sincerely,

Ben P. Sax

"For the job that's TOUGH—use an AMERICAN BUFF"



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Patented CENTERLESS Construction
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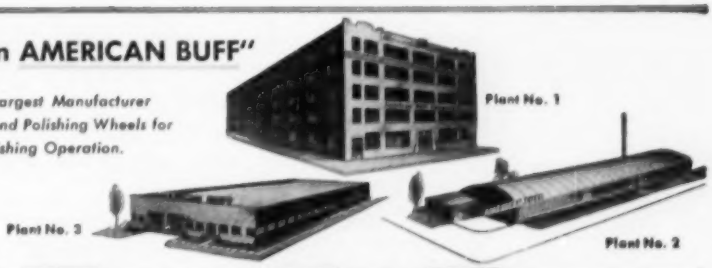

American Buff Company

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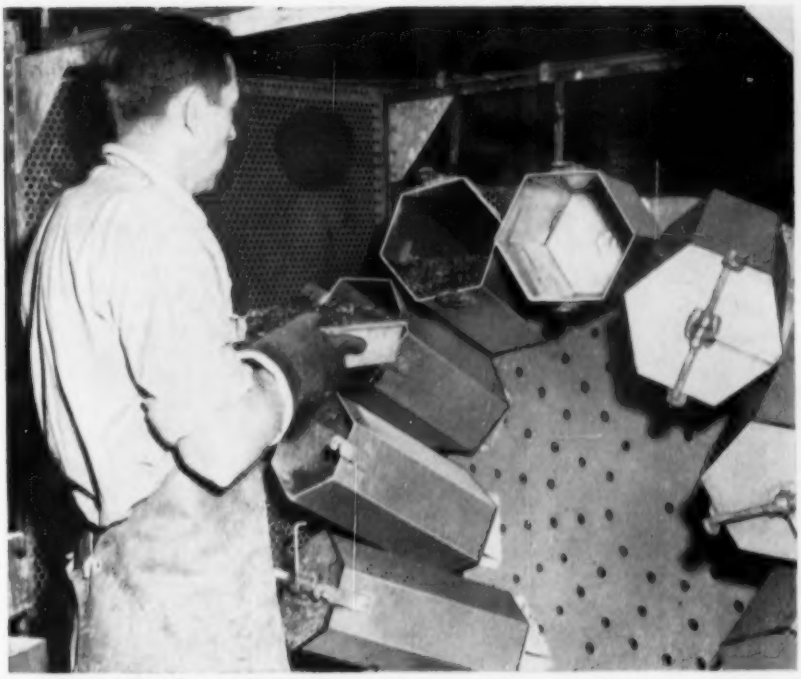

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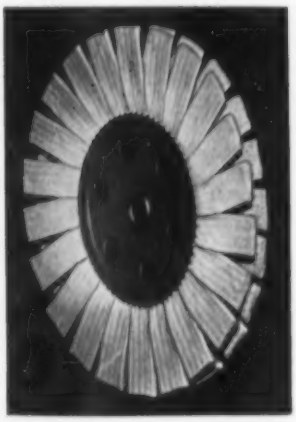

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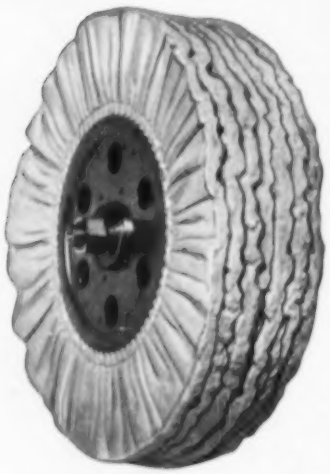

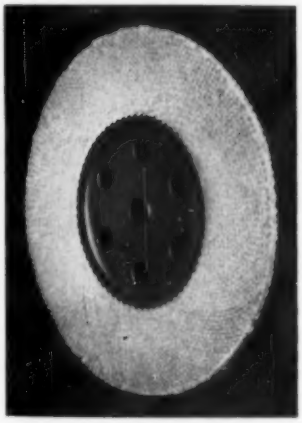

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P2-8-3

DU PONT PRODUCT NEWS

A new high-speed cyanide copper plating process

DU PONT is now offering a new copper process for plating steel parts and zinc die castings. This new bath has been thoroughly field-tested, and is producing high-quality results on automobile bumpers and grilles, hardware products and wire.

In addition to high-quality results, you get these other advantages with Du Pont's new high-speed copper-plating process:

Low maintenance cost—An inexpensive cyanide electrolyte is used that is easily maintained with Cyanobrik® sodium cyanide or Du Pont high-purity potassium cyanide.

Simplicity—Only two new addition agents are needed. The first is Elchem 1396 which sequesters organic contamination and, by promoting smooth anode corrosion, assists in the production of smooth deposits. The other new addition agent—Elchem 1393—greatly increases the bright plating range of the bath and serves as a brightener.

Low use-cost of addition agents—means Du Pont's new Copper Plating Process is *economical* as well as effective.

Consistent, easily-controlled performance—Day-to-day performance is highly uniform—even after shutdowns. Use of the two addition agents—which are stable in the bath—contributes to this trouble-free operation.

Your existing high-efficiency copper bath can probably be converted to the new Du Pont plating process with minimum disturbance of production. For the complete story on this new high-quality copper-plating process, write or use the coupon on the next page.

BRILLIANT COPPER-PLATED BUMPER GUARDS are removed from laboratory experimental bath. New Du Pont Process gives bright, smooth coatings at higher current densities.

A new plating chemical . . . sodium copper cyanide double salt . . . is manufactured by Du Pont specifically for make-up and maintenance of copper-plating solutions formulated with sodium cyanide. Advantages: facilitates make-up and replenishment of plating solution, cuts handling of chemicals, eliminates error in bath make-up and replenishment. Check and return coupon for more information.

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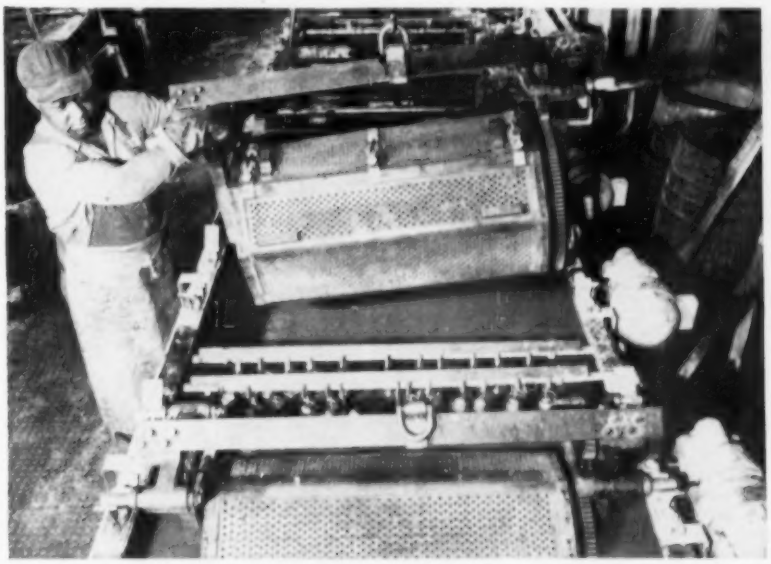

BARREL PLATING with Du Pont ZIN-O-LYTE. Brilliant deposits are obtained directly on parts of all sizes and shapes.

ZIN-O-LYTE® brightener special can cut zinc plating costs

No bright dipping required—because you get top-quality, brilliant blue-white zinc plating directly from the barrel with Du Pont "Zin-O-Lyte" Brightener Special. This new formulation is specifically designed to cut your operating costs at no sacrifice in quality.

Baths based on "Zin-O-Lyte" Brightener Special are easy to make up . . . economical to maintain . . . have good operating efficiency at both high and low current densities. Fully tested in production installations, "Zin-O-Lyte" Brightener Special is a readily soluble powder available in non-returnable Fiberpak drums. Like all "Zin-O-Lyte" zinc-plating chemicals, it is a highly uniform product giving consistently excellent results.

For further information about "Zin-O-Lyte" Brightener Special or any of the other plating chemicals in Du Pont's extensive line, just fill out and mail coupon below.

Du Pont will help you solve your plating problems

Du Pont's team of plating specialists is always available for help whenever you need it. Even if you have no serious problems, Du Pont will be glad to show you how to get the most for your plating dollar!

The Du Pont technical representative who calls on you can draw on years of trouble-shooting experience to help answer your plating questions. And he's backed by Du Pont's service and research labs. Here's where your plating problems can be studied and a detailed report prepared for your review.

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Checking a plating solution in Hull Cell apparatus. Du Pont service and research facilities are always available for the benefit of platers using Du Pont's quality cyanides.

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Producing quality toys with eye-appeal to sell at competitive prices demands the best finishes possible at the most economical cost. That's why Hubley—one of the world's foremost toy manufacturers—plates with OFHC Brand Copper Anodes.

Hubley plating men attest that anode consumption for a specified coverage and thickness of plate has been reduced appreciably since they changed to OFHC Anodes.

OFHC Anodes yield these results because OFHC means *more plating per pound of copper*. OFHC is completely free of porosity—equal in density to forged copper, is 99.99+% pure, contains no oxides, no deoxidants. And OFHC Anodes' characteristically long-grained crystal structure and high purity combine to resist undercutting of small grains. This fact both minimizes the amount of copper wasted through the loss of small grains and eliminates the roughness caused by small particles free in solution.

To find out how the extreme purity of OFHC Copper Anodes can benefit your own electroplating operation, contact your distributor or our nearest office directly.

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What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

Why clean ferrous and nonferrous metals in separate tanks? *See page 10.*

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page 21.*

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 24.*

Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 28.*

What's the best way to clean parts that are too large to be soaked in tanks or conveyed through washing machines? *See page 30.*

Does your burnishing barrel produce a luster you are proud of? *See page 32.*

What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page 37.*

New "Technical Proceedings" Now Published and Available

CONTAINING a full record of the 44th Annual Convention of the American Electroplaters' Society (AES) held in Montreal, Canada, June 17–20, 1957, the AES's 1957 Edition of TECHNICAL PROCEEDINGS has made its appearance, and members' copies are issuing to AES members globally.

It publishes in full each of the technical papers delivered by experts at the six Educational Sessions of that fertile 1957 Convention, including their charts, diagrams, graphs, tables and other illustrations, plus the verbatim discussion that followed their delivery. A veritable treasure chest of technical information, the document enriches technical and scientific knowledge in the field of electroplating, metal finishing and allied arts.

In addition, the book provides a narrative/pictorial account of the Convention itself, and a summary of transpirings. It includes, moreover, an up-to-date listing of 1957–1958 AES Boards and Committees, and presents a full directory of the Society's 57 Branches in the United States, Canada and Australia.

This book is the only printed medium in which all of the 1957 Convention's technical papers, and the wealth of technical and scientific data that they impart, will be published. Its scope and coverage are demonstrated by its array of papers listed below.

AES headquarters has received many inquiries from non-members regarding the availability of copies of this 1957 book for purchase, and its market price.

Because of the stature of members' needs, only a comparatively limited quantity of this 1957 Edition of TECHNICAL PROCEEDINGS exists for sale to non-members. In a spirit of cooperation with non-members who, recognizing the book's import and value, desire copies, their orders will be accepted and processed by the AES *on strictly a first-come first-served basis so long as the AES's limited supply lasts.*

The domestic price of the 1957 Edition of TECHNICAL PROCEEDINGS is $10 per copy including postage. To those ordering from outside of the United States' continental limits, the charge is $12 per copy including postage. *All orders must be accompanied by payment in full so as to obviate unnecessary bookkeeping expense.* Address orders and make checks payable to:

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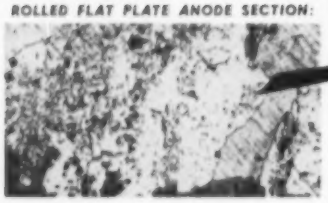

This Photomicrograph shows highly irregular, uncontrolled grain size—a major cause of shedding and resultant rough electrodeposits.

Note small, fully controlled regularity of grain size that promotes uniform corrosion, smoothest electrodeposits, less rejects.

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Be certain the silver you buy in anodes is used most efficiently and economically. Our service department will be glad to develop special anode shapes to meet your particular plating bath conditions. Call or write for a representative, we'll be glad to assist with your anode problems. ★ ★ ★ ★ ★ ★

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Winter Scene at Rocky River, Ohio, home of ROHCO PLATING SPECIALTIES.

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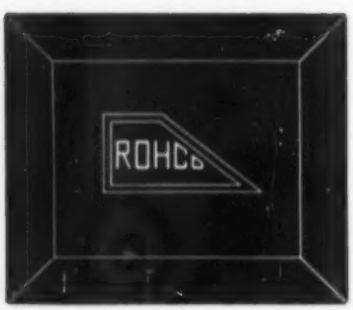

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HOST: AES INDIANAPOLIS BRANCH

INTERIM MEETING REPORTER

HOTEL MAROTT INDIANAPOLIS, IND. JANUARY 11, 1958

BRANCH DELEGATES INVITED TO INDIANAPOLIS BRANCH MEETING

Upon accepting the Executive Board's invitation to host the Fifth Interim Meeting, the Indianapolis Branch promptly altered its regular Branch Meeting night so that, by holding it the evening before the Interim Meeting, visiting National Officers, Delegates and Alternates can be present.

Scheduled to be held in the Marott Hotel, the Branch Meeting will follow a Branch dinner in the Hunt Room starting at 6.30 p. m., which will be open to all National Officers, Delegates and Alternates. Priced at $2.75 per plate, it will feature the well-known Marott Smörgasbord. The Branch Meeting itself is expected to commence about 8 p. m.

DECEMBER 15 IS DEADLINE FOR HOTEL RESERVATIONS

Delegates and Alternates planning to attend the Fifth Interim Meeting of the Supreme Society at the Marott Hotel, Indianapolis, January 11 and desiring hotel room reservations or Branch Dinner tickets are urged to communicate with M. Lester Reynolds promptly. His address is 328 East 47th Street, Indianapolis, Indiana. Deadline for hotel reservations necessarily is December 15, 1957.

SOCIAL EVENTS AS INTERLUDES AT FIFTH INTERIM MEETING

Apart from its business side, the Fifth Interim Meeting will provide opportunity for reunion with old friends, always a feature of AES assemblies. One such occasion will be the Branch meeting, Friday evening, January 10. Another will be the Interim Meeting's "dutch treat" luncheon priced at $3.30 per person. Finally, the cocktail party that will immediately follow adjournment of the Interim Meeting itself will be a real chance to visit with old friends. All Delegates and Alternates will be the guests of the Society.

INTERIM MEETING TO SERVE AS ANNUAL MEETING SOUNDING BOARD

Plans are fast progressing for the Fifth Interim Meeting of the Supreme Society, AES's governing council, to be held at the Marott Hotel, Indianapolis, Indiana, Saturday, January 11, 1958, starting at 10 a. m., with the Indianapolis Branch serving as Host Branch. Compared with 25 Branches represented at last January's Interim Meeting held in Pittsburgh, Pennsylvania, it is hoped that this Fifth Interim Meeting will turn out an even wider representation of the Society's current 57 Branches.

Under the leadership of National President Francis T. Eddy, a new form of Interim Meeting Agenda is being innovated. In presenting it to the Executive Board for ratification, he said, "This, I appreciate, is a deviation from anything that has been done in the past, but, in my opinion, it is necessary in order that it may be of value to the Society. We have been bound up in unnecessary reporting and also irrelevant discussion in previous years. By concentrating discussion in a constructive direction, the Interim Meeting can be of even greater value." The Tentative Agenda is presented elsewhere on this page.

Marshal L. Whitehurst, as General Arrangements Chairman, is leading a strong Indianapolis Committee in creating effective arrangements and setting for this Interim Meeting. He is being assisted by M. Lester Reynolds, *Reservations and Housing;* Edward Bruck, *Registration;* Quentin Shockley, *Branch Dinner and Interim Meeting Luncheon;* Elmer Lundberg, *Equipment and Notices;* Roman Bender, *Cocktail Party* and John Holland, *Finance.*

The Executive Board will meet in regular session on Friday, January 10, and will continue its meeting on Sunday, January 12.

If you are a Branch Delegate/Alternate residing reasonably near Indianapolis, your presence at the Interim Meeting is urged. It will give you a preview of subjects and matters likely to be considered and acted upon at the Annual Meeting of the Supreme Society to be held May 22, 1958, in Cincinnati.

AGENDA
FIFTH INTERIM MEETING
AES SUPREME SOCIETY
HOTEL MAROTT, INDIANAPOLIS
JANUARY 11, 1958

1. **Roll Call**
2. **Welcome by the Indianapolis Branch**
3. **Welcome by the National President**
4. **Opening of the Session as an Interim Meeting**
   Purpose of the meeting as a sounding board on matters for subsequent consideration and action by the Supreme Society at its Annual Meeting in Cincinnati in May, 1958.
5. **Reports:**
   - Financial by President
   - Educational by First Vice President
   - Membership by Second Vice President
   - Constitutional/Bylaw Amendments by Third Vice President
   - AES Scientific Achievement Award by Past President
   - Headquarters and Publishing by Executive Secretary
   - Cincinnati Convention by Branch General Chairman
6. **Comments and questions from the Floor:**
   - Educational aspects of the Society
   - Educational Program
   - Organic Finishing
   - Finishing Expositions
   - Plating courses
   - Any other
7. **Preliminary report of the Structure of the Society Committee and discussion thereof.**
8. **New business brought for discussion by Delegates, including announcement of candidacies for Third Vice Presidency.**
9. **Discussion of Interim Budget (April 1 through June 30, 1958) required by transition to the Society's new fiscal year (July 1, 1958–June 30, 1959), and matter of Branch transition as to per capita taxes.**
10. **Adjournment.**

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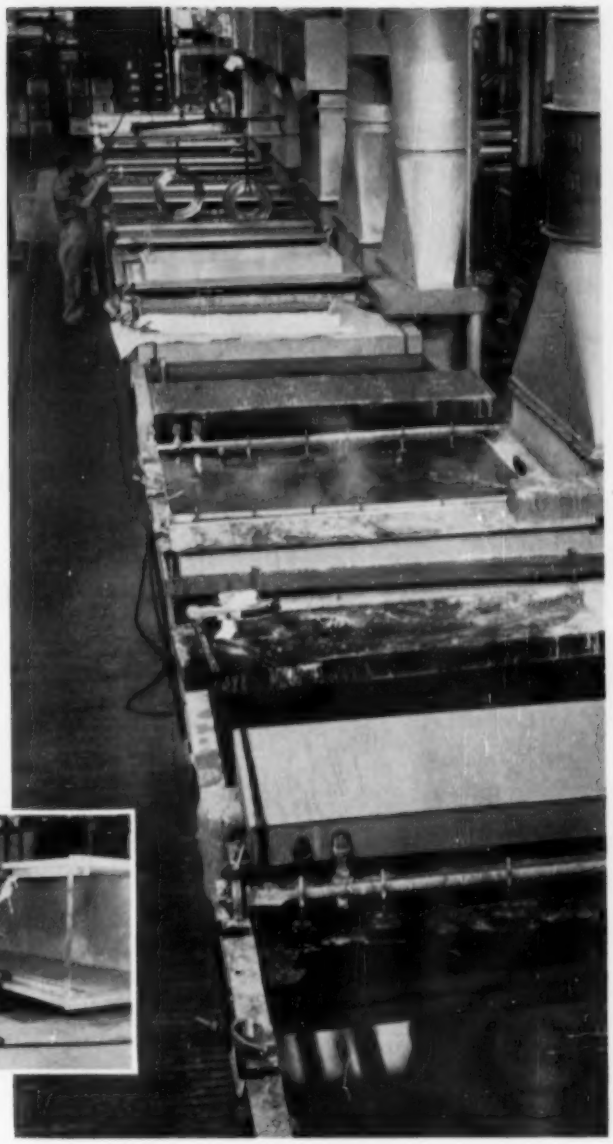

Lined with Unichrome Plastisol, the tanks at right are a few of hundreds made fit for a wide variety of plating and cleaning operations in one plant.

Sprayable "Super 5300" builds up thick vinyl film which blocks penetration of corrosive solutions. Large tanks fabricated in sections can be coated and then bolted after lining. Plastisol coating on tank exteriors (easily applied during lining) ends need for subsequent painting during plant maintenance.

. . . sprays seamless, pore-free protective coatings thick as sheet linings

MORE AND MORE plating plants are specifying Unichrome Plastisol instead of sheet lining for their tanks. One company, in fact, now has over 1000 cleaning and metal finishing tanks not only *lined* with this remarkably durable material, but "lifetime" coated on *exteriors* as well.

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Unichrome Plastisol securely seals tanks against corrosion, protects solutions from contamination. An acid and alkali resisting vinyl coating, its chemical inertness makes tanks more versatile . . . interchangeable for a wide variety of work.

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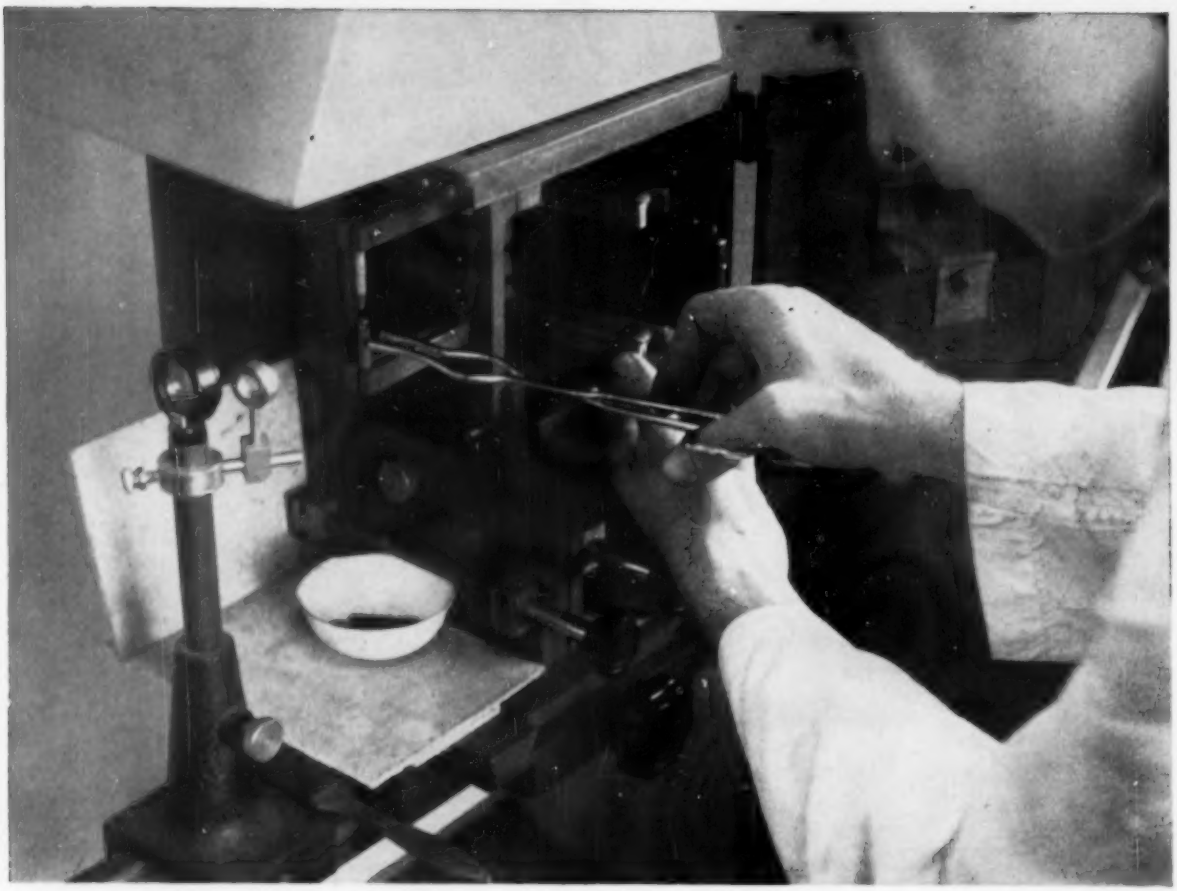

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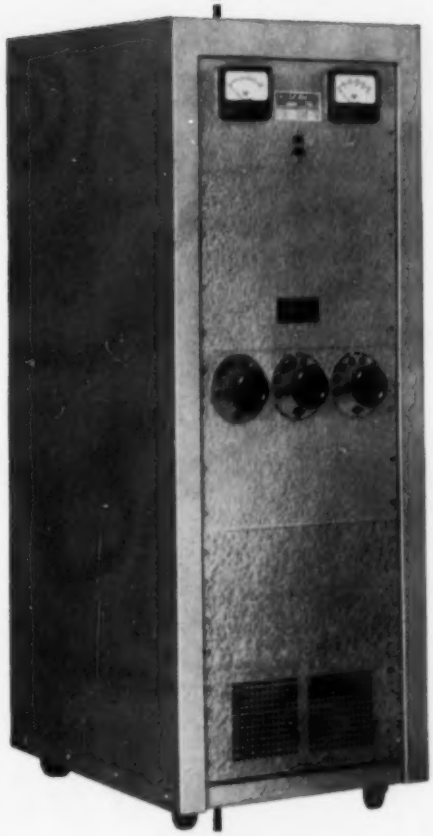

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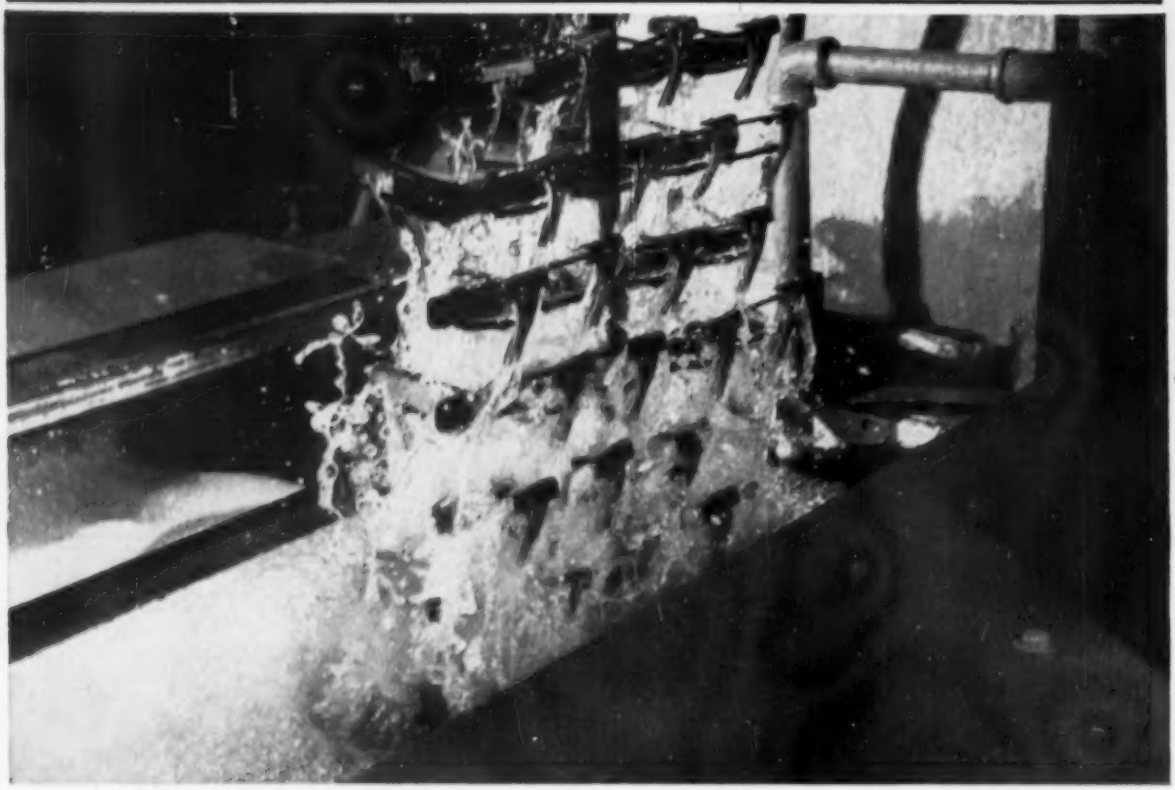
REPORT NO. 6 / ON LOWERING TODAY'S COST OF PRODUCTION



Soak cleaners that eliminate solvent pre-treatment on most work

Step up production, lower cleaning costs

Faster, more efficient production often hinges on quick-working compounds and a minimum number of production steps.

Diversey heavy duty alkaline soak cleaners No. 404 (for brass and steel) and No. 909 (for all metals), save up to 50% of present cleaning costs *on most work* by eliminating solvent dips . . . eliminating hand cleaning and wiping . . . eliminating vapor degreasing. Fast, thorough, non-caustic cleaning action removes quenching oils, buffing compounds and other soil, making solvent pre-treatment operations unnecessary.

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The cleaning and draining efficiency of Diversey soak cleaners often bring unthought of economies. Dramatic proof of this performance superiority is, *in some plants*, work passes from No. 909 solutions *directly* into electro-cleaning baths without the need for an intermediate rinse! Of course, many operations require a rinse . . . in those cases, both No. 404 and 909 rinse waterbreak-free.

Both cleaners are absolutely safe on recommended metals. Even highly active metals such as aluminum are cleaned safely and with ease by No. 909.

There's an added margin of safety for your men also. Both No. 404 and No. 909 are mildly alkaline, non-toxic and non-caustic. They will not sting, burn or cause dangerous skin irritation.

For literature on these two products, write today to *Metal Industries Department, The Diversey Corporation, 1820 Roscoe Street, Chicago 13, Illinois.*

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Liquimatic COMPOUND

How and why it saves time, saves money—and does a better finishing job—any job—on all metals!

Liquimatic Compound works by the "heading-up" principle. The compound is pushed against the work by the buffing wheel. What happens when the compound goes to work on the metal is almost like magic. The outstanding heading-up properties of Liquimatic Compound make it able to take the heaviest cuts, fast. Yet, it can be "toned down", easily. Viscosity can be controlled to suit any application, including extreme high-color work. Whatever the job, the *compound* does the actual work—not the buff. And it lubricates as it cuts. This, naturally, saves buffs. In fact, 200% savings in buff life have been reported . . . and that's not a bit unusual for Liquimatic users.

There are plenty of other savings, too. There's never any waste with Liquimatic. You use just what you need for the job. No nubbins or re-melt, as with bar compounds. Saves material. No changing of bars by hand. Saves production-killing downtime.

Liquimatic is water-soluble—it cleans readily, making your maintenance a lot simpler and faster. Clean it off easily, completely, by any of these methods:

- Spray washer—1 oz./gal. at 140-160 F. for from 2 to 4½ minutes of washer time.
- Alkaline or di-phase emulsion soak—2½ minutes, followed by ½ minute hot alkaline spray.
- Solvent degreaser.

Liquimatic is non-settling and has a very long storage life. You can store it almost anywhere—even temperatures down to the freezing point won't affect it. Let it come back to room temperature and it's good as new.

Liquimatic is non-plugging, thereby offering continuous operation with no interruption of spray after downtime periods.

THE Liquimatic SYSTEM

Simple, easily installed automatic application equipment with exclusive metered master control assures economy, efficiency, uniformity.

Economical heavy-duty Liquimatic pump

Three simple basic elements form the Liquimatic automatic application system: the pump, the master control, and the spray guns. The heavy duty, long-stroke, air-actuated pump is specially engineered for smooth, failure-proof delivery of abrasive liquids. It has a built-in pressure regulator and gauge, and it can be adapted for 30 or 50 gallon drums. An air operated pump elevator for easier drum replacement is also available.

The master control sets and maintains uniform pressure—at every gun outlet. This unit is specially designed for exact *metered* control of Liquimatic Compound, when applied with Liquimatic equipment.

"Business end" of the Liquimatic System is the automatic spray gun. At all buffing stations, these guns deliver the liquid by means of a 3-way internal valve system that eliminates spitting and dripping. Each gun has its own adjustable pattern control, as well as an adjustable material needle valve to compensate for wear.

The electrical timer unit is an important additional feature of the Liquimatic System. It automatically controls the length of "on" and "off" repeating time cycles for each complete spray system. Still, the system is completely flexible because guns have individual variable controls. You can "trigger" each gun—make its time cycle longer than that set by the master control. You always get the exact amount of compound, pin-pointed to the needs of each buffing station, regardless of variations in demand.

Liquimatic electric timer unit

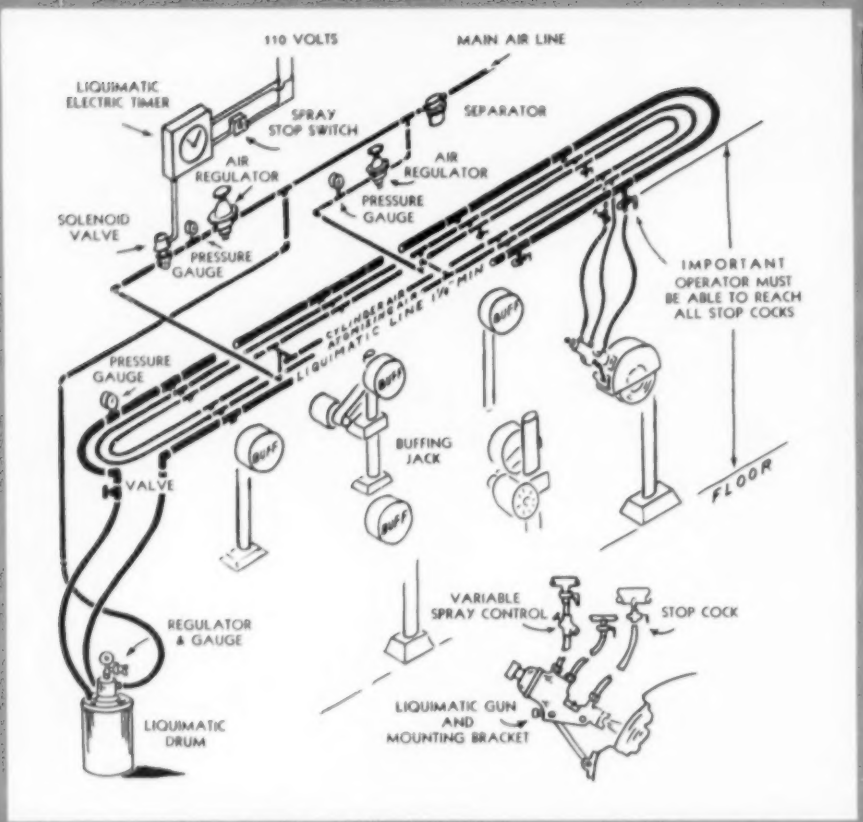
Liquimatic application gun

Liquimatic equipment is engineered to prevent line losses. Fluid pressure to each gun or bank of guns is equalized—automatically. The farthest gun gets the same pressure as the one nearest the tank.

Once installed, Liquimatic equipment operates with remarkable efficiency, and requires amazingly little attention. For the Liquimatic System is the result of years of research and development by top H-VW-M engineers. Exhaustive factory and field tests have proved its ability to step up production, insure uniform product quality and reduce downtime—effecting substantial savings in time and material.

Want to know exactly how much money you save when you go *Liquimatic*?

Get a free "Liquinalysis". An H-VW-M engineer can show you just how much time and money you can save your plant. He'll demonstrate the advantages of the Liquimatic System right in your buffing room. If you need a special formula, you'll see how simple it is to formulate one that will meet your viscosity or consistency needs. There's no obligation, and no interference with production schedules or your personnel . . . the test gear can be set up parallel to existing equipment. So, whether you use liquid or bar buffing compounds, be sure to see Liquimatic in action. H-VW-M offices are located in principal cities all over the country. There's one near you. Let us know your needs. Take advantage of this free offer now.



The diagram shows a normal multiple-head installation, as used in many of America's leading plants. Simple and neat, it is easily adapted to meet individual plant practice or job requirements

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4536

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ELECTROFORMING OF LINEAR ACCELERATOR STRUCTURES*

by JAMES A. POPE†

This report covers the equipment and techniques used at Stanford University for the electroforming of copper linear electron accelerator structures. Electroforming of these structures is preferred over mechanical fabrication techniques (such as shrink-fitting copper disks in a copper pipe) because it allows baking of the structure at high temperatures for purposes of outgassing and subsequent sealing-off of the vacuum-tight accelerator tube. The electroforming procedure also suffers the advantage of a stress-free final structure, in contrast to mechanical fabrication, and therefore provides a greater degree of dimensional stability which is of great importance in accelerator operation. Other advantages are: (1) the ability to fabricate long accelerator sections with good accuracy (five feet is the maximum length electroformed to date but a 10-ft length is considered feasible), and (2) the relative ease of fabricating accelerator structures of non-uniform dimensions.

I. INTRODUCTION

DURING THE PAST FEW YEARS the W. W. Hansen Laboratories of Physics at Stanford University have been engaged in the manufacture of electroformed linear electron accelerators. The electroforming process was used primarily to allow baking of the accelerator structures at elevated temperatures for purposes of outgassing; following the high-temperature bake it is possible to seal off the accelerator tubes independent of a vacuum system. The electron gun, input radio-frequency power coupler, and electron beam output window are joined to the accelerator tube by gold-diffusion seals.

The structures which have been electroformed consist of hollow round tubes periodically loaded with copper disks. A circular aperture in the center of the disks provides a path for the flow of radiofrequency power and for the passage of the electron beam.

The electroforming procedure consists of the following steps:

(1) The copper disks are machined to size and assembled on a cylindrical mandrel. The disks are properly spaced by means of aluminum spacers which are stacked alternately with the copper disks on the mandrel.

(2) The mandrel assembly is placed in an acid copper bath, and the outer wall is electroformed over the disk-spacer assembly.

(3) After removal from the electroforming tanks, the mandrel is withdrawn and the aluminum spacers are etched out in a hot caustic solution.

The copper disks and electroformed outer wall remain, unaffected by the etching. The final product is an all-copper assembly. The disks are firmly bonded to the outer wall, producing a structure which has good mechanical strength and low radiofrequency power losses. A more detailed description of this procedure is given in the following sections of this report.

II. COMPONENTS

In the particular method most commonly used at Stanford, the basic components required for an electroformed accelerator are copper disks, aluminum spacers, and a stainless steel mandrel on which the disks and spacers are assembled alternately.

A. Mandrels

Two types of mandrels are in use (both made of type 304 stainless steel):

(1) *Mandrel of uniform diameter over entire length* (for use where holes in accelerator disks are of constant diameter). This mandrel is made in two sections and is assembled to obtain the desired length. The mandrel has an outside diameter of 0.818 in. and is 66 in. long. The diameter is 0.004 in. less than that of the holes in the disks and spacers.

(2) *Non-uniform mandrel* (for use where holes in accelerator disks vary in diameter). One particular mandrel is graduated in 24 steps from 1.552 in. outside diameter at top to 0.727 in. outside diameter 20 in. from the top. The steps vary in length with the position on the mandrel. In the remaining length the outside diameter of the mandrel is held constant at 0.727 in. The mandrel is made in three sections and these are assembled to obtain the desired length.

B. Copper Disks

The standard copper disks are machined from OFHC copper. These have an outside diameter of 3.2537 in., and the thickness is 0.2300 in. The hole size is 0.8225 in., and the edges of the hole are rounded with a 0.120 in. radius.

C. Aluminum Spacers

The standard spacers are machined from 24 ST aluminum stock. They have a finished outside diameter of 3.2487 in., and the thickness is 0.8034 in. Six holes are drilled in the center web to facilitate faster etching of the spacers from the tube after the electroforming is complete.

D. Preparation of Aluminum Spacers

It is not desirable to plate from an acid copper bath directly onto the aluminum spacers between copper disks for two reasons:

(1) The acid copper bath attacks the aluminum, resulting in poor adherence.

(2) An electro-couple is set-up between the copper disks and the aluminum spacers causing imperfections in the plating at the junctions.

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† Research Electrocloster, W. W. Hansen Laboratories of Physics, Stanford University, Stanford, California.

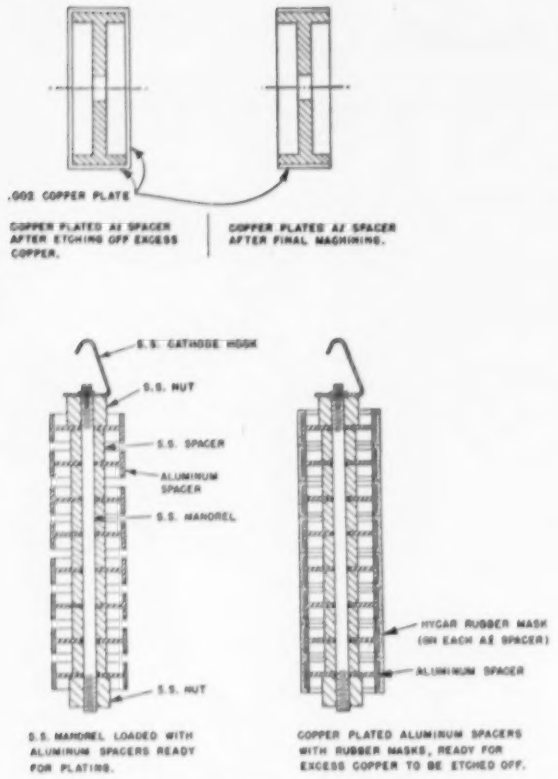
.002 COPPER PLATE
COPPER PLATED AT SPACER AFTER ETCHING OFF EXCESS COPPER.
COPPER PLATED AT SPACER AFTER FINAL MACHINING.
S.S. CATHODE HOOK
S.S. NUT
S.S. SPACER
ALUMINUM SPACER
S.S. MANDREL
S.S. NUT
HYCAR RUBBER MASK (ON EACH AT SPACER)
ALUMINUM SPACER
S.S. MANDREL LOADED WITH ALUMINUM SPACERS READY FOR PLATING.
COPPER PLATED ALUMINUM SPACERS WITH RUBBER MASKS, READY FOR EXCESS COPPER TO BE ETCHED OFF.

Fig. 1. Copper plating of aluminum spacers.

For these reasons the aluminum spacers are placed on a special mandrel (without copper disks) and preplated in a cyanide copper bath before the final assembly with the copper disks.

After the spacers are machined, they are cleaned and positioned on the special stainless steel mandrel (see Fig. 1). The assembly is etched slightly in Oakite No. 61, water rinsed, 50 per cent nitric acid dipped for approximately 20 seconds, water rinsed, zincate dipped for one minute, and again water rinsed.

The assembly is then given a strike in a 120 F copper cyanide bath (0.5 oz/gal free cyanide, and a *p*H of 10–10.5) at 25 asf for one minute, and then at 15 asf for four minutes. The assembly is then transferred to a Dupont high-speed copper bath and plated at 30 asf for 36 minutes using a periodic reverse cycle: twelve seconds plate and two seconds deplate. The yield is 0.002 in. of copper.

Hycar rubber masks are placed on the periphery of the spacers, and the spacers are assembled on the stainless steel mandrel. The assembly is then dipped in a 50 per cent nitric acid solution, and the copper on the sides of the spacers is etched away. The rubber masks prevent etching of the copper plate which is on the periphery of the aluminum disks. The assembly is water rinsed and the rubber masks are removed. Some copper remains on the sides of the spacers near the periphery (where the rubber masks fit over the edge), but since the spacers are finish-machined to the correct thickness, this copper is removed.

E. Accessories

All nuts and washers are made of 304 stainless steel, as is the cathode hook. Stopoff caps are made of lucite. The cathode hook is threaded and may be attached to the mandrel. The top section of the hook contains a half-round phenolic roller to allow for rocking the assembly on the cathode bar. Electrical contact is made by a flexible copper lead which is bolted to the stainless steel mandrel and to the cathode bar (see Fig. 2).

III. ELECTROFORMING PROCEDURE

A. Assembly Tank

Assembly is made in an 18-in. diameter steel tank, 6-ft high, whose inner surface has been vinyl coated. The tank is divided into three sections (see Fig. 3). The bottom assembly tank section is cleaned and positioned directly under the monorail to facilitate removal after assembly by the hoist. The mandrel is degreased in trichlorethylene and alkali cleaned, then seated in the bottom of the assembly tank. The tank is first filled to a depth of about 10 in. with deionized water. Water is then added as the assembling progresses; this allows the assembler to work without having water go over the top of his gloves. The purpose of assembling the components in water is to fill the spaces between the disks and spacers with water to equalize the pressure between the inside and outside of the assembly. This serves to prevent any plating solution from leaking through. If leaking should occur, the inside surface of the finished accelerator would be damaged.

B. Cleaning of Disks and Spacers

The aluminum spacers are degreased in trichlorethylene and cleaned by soaking for two minutes in Oakite No. 61 cleaner at 170 F. They are water-rinsed and dipped for five seconds in 6 oz/gal solution of sodium cyanide at room tem-

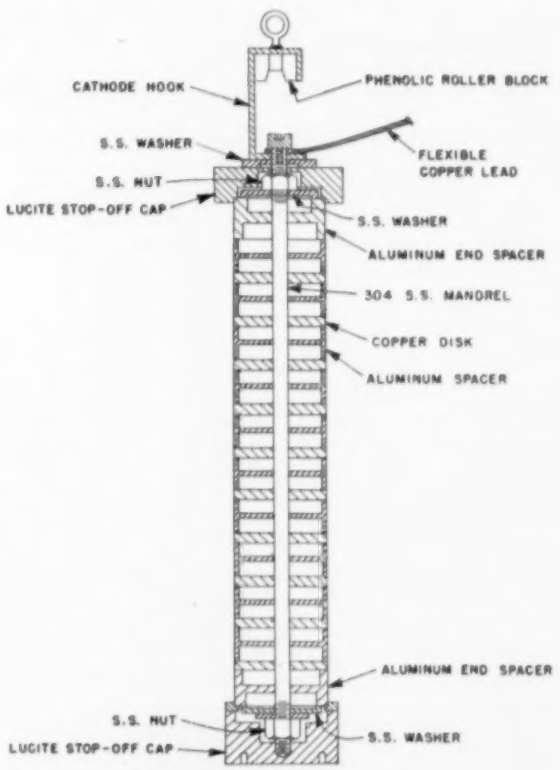

Fig. 2. Mandrel assembly with cathode hook.

Fig. 3. Assembly of spacers and disks on stainless-steel mandrel.

perature. The spacers are then water-rinsed and are ready for assembly. The copper disks are degreased in trichlorethylene and soaked in Enthone No. 160 copper cleaner at 180 F, then dipped for five seconds in a 6 oz/gal solution of sodium cyanide at room temperature. They are then water-rinsed and are ready for assembly.

C. Assembly of Disks and Spacers on Mandrel

The spacers and disks are assembled alternately on the mandrel. Spacers and disks are not touched with the bare hands after cleaning; surgeon's gloves are worn during the stacking procedure. The mandrel is then stacked with disks and spacers to within two in. of the top of the first section of the assembly tank. A lead gasket is put on the flange of the assembly tank and the second section of the assembly tank is placed on it. The flanges are securely bolted to prevent leakage. The second section of the mandrel is then attached. The water is brought up to the desired level and assembly is continued until the height of disks and spacers is within two in. of the top of the second section. At this time the third section of the tank is installed and the procedure is repeated.

A stainless steel washer is placed over the end spacer and tightened securely (to 25 ft lb). An eye bolt fitting is now attached to the mandrel. Then the water is drained from the tank and the top and center sections of the assembly tank are removed. The hoist hook is connected to the eye bolt, and the assembled section is hoisted to clear the bottom assembly tank section, which is then removed. While the mandrel is suspended, the lucite stopoff cap, cathode hook and flexible electrical lead are installed at the bottom of the assembly. The assembly is turned end for end and the hoist is connected to the cathode hook. The bottom lucite stopoff cap is attached to the mandrel and the assembly is now ready for plating (see Fig. 4).

The cleaning, water-rinse and plating tanks are located in a concrete trench 17 ft long, 3 ft wide and 5 ft 3 in. deep (see Fig. 5). The tanks are constructed of steel and are lined with $^{3}/_{16}$ in. of Koroseal.

D. Electropolishing

The assembly is moved directly over and lowered into the electropolishing tank. The assembly is electropolished at 150 asf for 40 sec and then is removed quickly and inspected for any imperfections in the copper surface. The surface should be bright and show no exposed areas of aluminum. The assembly is now water-rinsed.

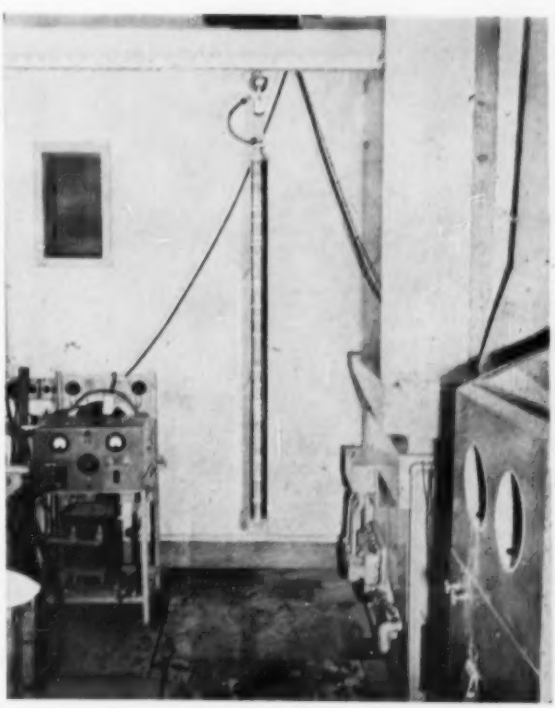

Fig. 4. Assembled accelerator section ready for cleaning prior to electroforming.

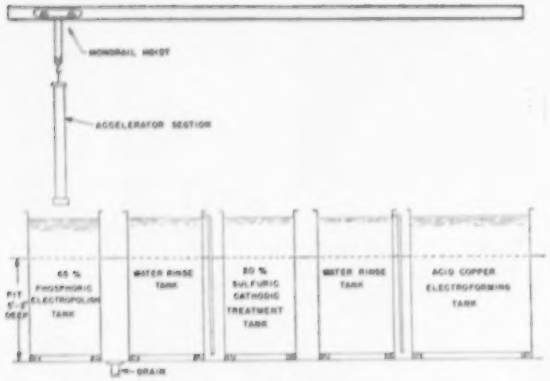

Fig. 5. Treatment and plating tanks for electroforming accelerator.

The electropolishing solution contains 65 per cent phosphoric acid and 35 per cent water, and is maintained at room temperature. The six cathodes and supporting hooks are copper. The cathodes are ¼ in. by 6 in. by 6 ft long. The power is provided by a copper oxide rectifier which supplies 750 amp at 12 volts.

E. Cathodic Treatment

After the section is thoroughly water-rinsed, the assembly is transferred to the cathodic treatment tank. After electropolishing in phosphoric acid the copper surface has been rendered passive by an oxide-phosphate film and must be activated to insure a sound bond between the copper of the assembly and the plate from the acid copper bath. This is accomplished by the cathodic treatment in sulfuric acid, as described below.

The solution for the cathodic treatment of the assembly is 20 per cent cp sulfuric acid at room temperature. The anodes are of chemical lead ½ in. thick, 4 in. wide and 6 ft long. The assembly is treated cathodically at 100 asf for 15 sec at 6 volts, at which time vigorous gassing should result. The assembly is inspected for water breaks or any imperfections, and then transferred to the second water-rinse.

F. Electrodeposition

After a thorough rinsing in water the assembly is transferred to the acid copper bath, and the flexible lead is connected to the cathode rod. The assembly is now plated at 40 asf at approximately 0.4 volts. Cathode rod agitation is used with an 8-in. stroke and 15 cycles per minute. Approximate swing of the bottom of the assembly from vertical is 10 in. when the cathode rod is reversing its stroke.

The acid copper solution consists of a 10 oz/gal solution of cp sulfuric acid and a 32 oz/gal solution of technical grade copper sulfate. In making up the bath, the copper sulfate is dissolved in a spare tank partially filled with de-ionized water. The solution is heated to 130 F and agitated vigorously with air. A solution of 3 oz/1000 gal of potassium permanganate is added, and the bath is agitated for four hours. Five lb per 100 gal of activated carbon is added, and the solution is agitated hot for another four hours. After this the agitation is stopped and the carbon is allowed to settle for eight hours, or overnight. The solution is then pumped through a filter into a clean plating cell, and the proper amount of cp sulfuric acid is added. The bath temperature is maintained at 90 F with a 2000 watt quartz heater, thermostatically controlled.

The electroforming tank contains a ½ in. stainless steel rod diaphragm frame coated with Unichrome 218X plastisol to prevent stray currents. Inside the frame is an orlon diaphragm of double thickness. The diaphragm bag is tied to the frame along the sides, top and bottom to prevent movement of the bag from the agitation of the solution. Two Alsop filter pumps are used, each having a capacity of 500 gallons per hour. These pumps contain No. 51 horizontal asbestos pads, each charged with one lb of activated carbon. Filter hoses are ⅛-in. wall Tygon tubing (see Fig. 6).

The solution is drawn from the anode side and pumped to the cathode side. This maintains an overflowing hydrostatic

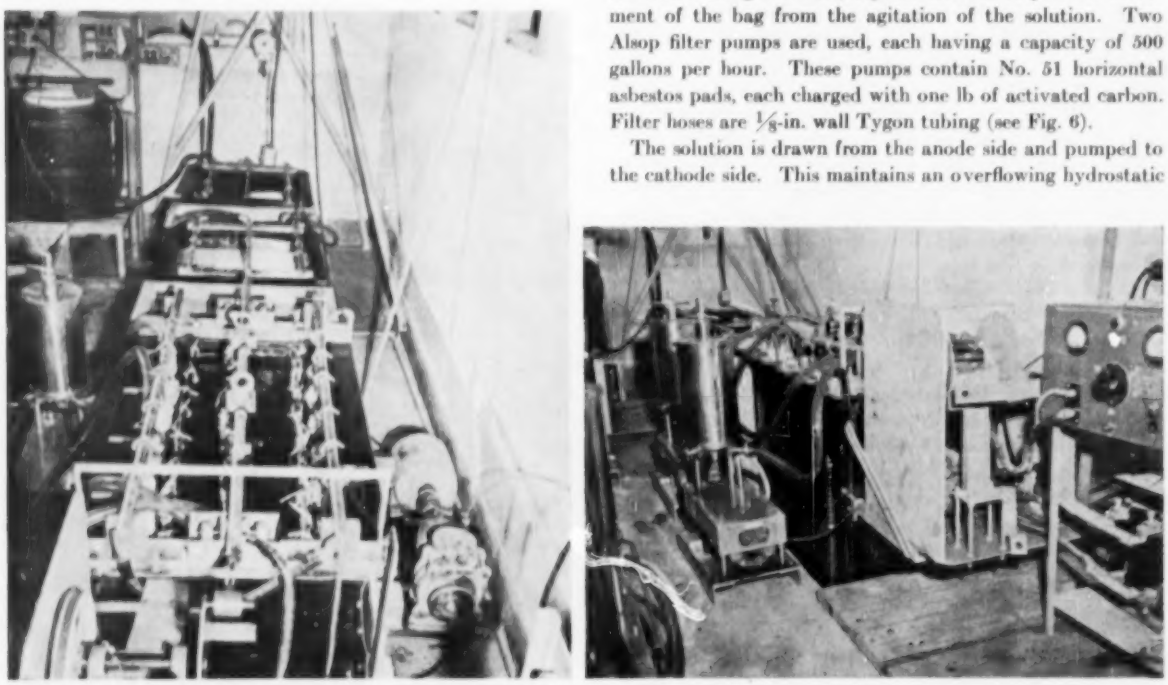

Fig. 6. Cleaning and electroforming tanks: (Left) Cleaning of the section after assembly is started at the rear tank and then progresses to the electroforming tank in the foreground. Note cathode diaphragm system. (Right) Two 500 gal/hr Alsop filters charged with activated carbon supplying 24 hr filtration to electroforming tank.

Fig. 7. Electroformed accelerator section (3/8 in. copper wall).

head of approximately 2 in. and prevents anode particles from migrating to the cathode. This insures a well-balanced solution. The anodes are rolled annealed oval copper bars 6 ft long suspended by monel inverted V anode hooks.* The filters are changed every week during the plating process and charged with activated carbon. No additional agents or wetting agents are added to the bath.

The assembly is plated for an average of four to five weeks at a plating current density of 10 asf. This produces a deposit thickness of 3/8 in. After the desired thickness has been plated the assembly is removed from the bath and rinsed in running water (see Fig. 7).

G. Etching

The assembly is then moved to the machine shop where the cathode hook, stopoff caps and mandrel are removed. The necessary machining is now done on a lathe, and the section is ready for the aluminum to be etched from the assembly. The etch tank is made from 55-gal steel drums welded together. It is oriented in a vertical position (see Fig. 8). The etching solution used consists of 2 lb of commercial-grade sodium hydroxide per gal of water. The etch tank is filled two-thirds full of water and the circulation pump is started. The proper amount of sodium hydroxide is now added slowly to the tank, and the water is then brought to the proper level. Due to the heat of reaction of the sodium hydroxide and water no external heat is required. The assembly is lowered into the etch tank and immediately vigorous action takes place. Precautions must be taken to keep personnel away during the etching. Approximately five hours are required for etching the aluminum spacers from the assembly. After all action appears to be stopped, the tube is agitated slightly and is then inspected for any gassing. This is a check to see if the etching is complete. The assembly is then removed from the etch tank and washed with water. It is now ready for final cleaning.

H. Final Cleaning

The assembly is mounted in the cleaning rack. It is next sprayed with the various cleaning solutions using a 6-ft length of 3/8 in. copper tubing covered with Tygon hose. The end of the hose is blocked off and small holes are drilled in the last 2 in. to form a spray (see Fig. 9). The cleaning solutions are made up in 5-gallon glass bottles prior to the cleaning.

Five gallons of 10 per cent nitric acid solution are pumped into the assembly by moving the spray unit up and down through the tube. The tube is flushed with five gallons of water and the area is hosed off. Then five gallons of 6 oz/gal solution of sodium cyanide is sprayed through the tube. The tube is water-rinsed, sprayed with five gallons of de-

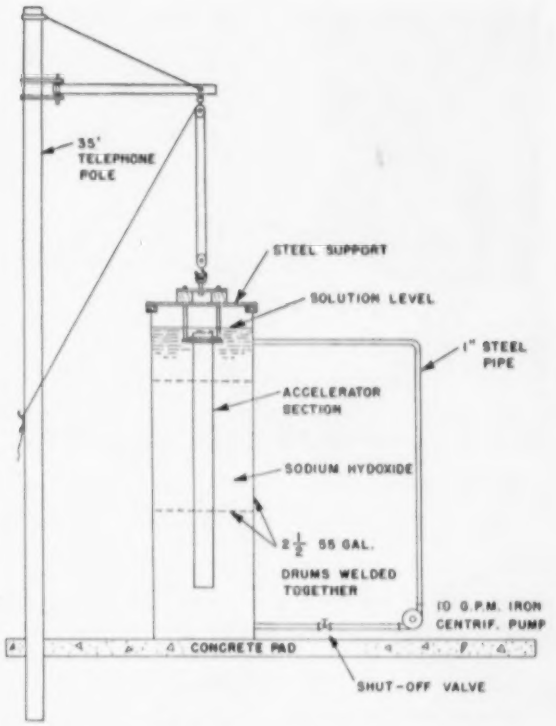

Fig. 8. Spacer etching setup.

ionized water and then sprayed with five gallons of methanol. All solutions are at room temperature. The tube is removed from the rack and dried in a rough vacuum system. After

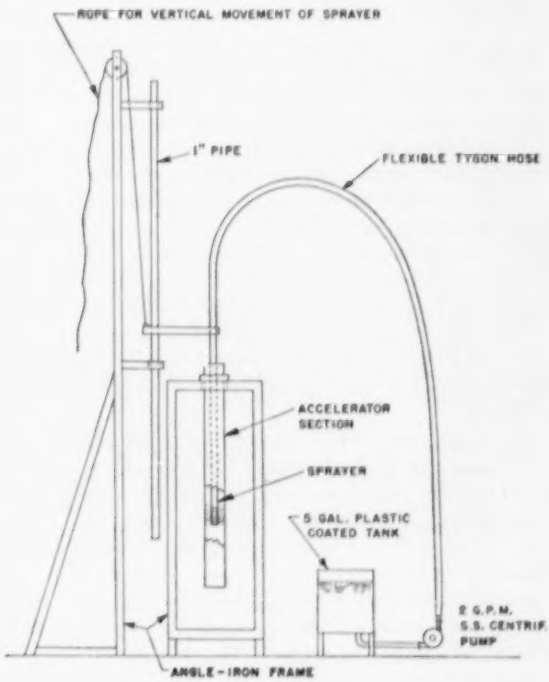

Fig. 9. Cleaning setup for accelerator tubes.

* OFHC anodes are now available and their use might partly eliminate the problem of anode sludge.

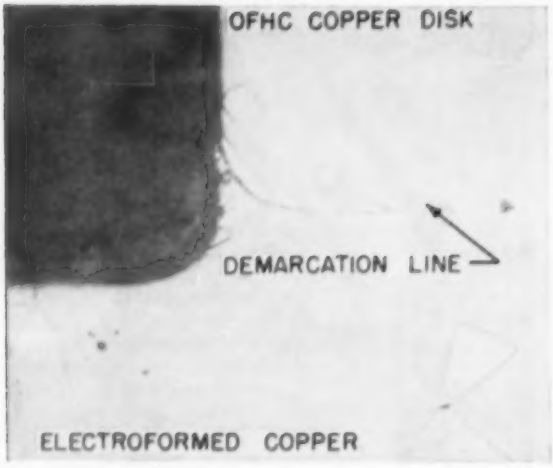

Fig. 10. Photomicrograph of bond between OFHC copper disk and electroformed copper, showing demarkation line caused by improper activation of the assembly after phosphoric acid electropolishing. Magnification: 90X.

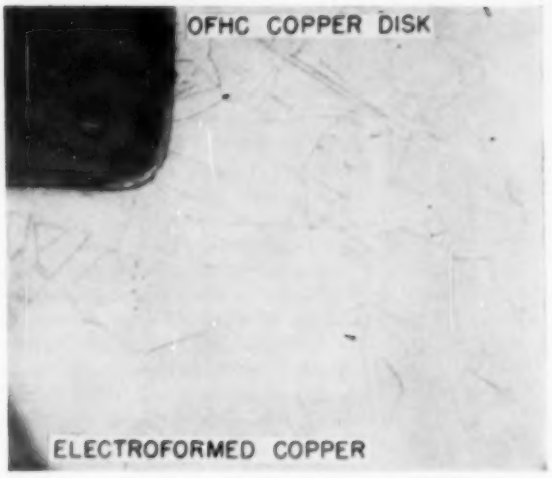

Fig. 11. Photomicrograph of bond between OFHC copper disk and electroformed copper, after cathodic treatment in 20 per cent H_2SO_4. Magnification: 48X.

drying, ends of the tubes are covered with polyethylene covers to prevent any foreign material from entering.

IV. CONCLUSIONS

The work that has been done in the last year has produced consistently good, vacuum-tight copper. This has been very gratifying, considering the number of joints produced by sandwiching the spacers and the disks, and the possibility of imperfections of the plate around these joints.

We have been limited in speed of plating by the necessity of not using addition agents that might co-plate with the copper to produce voids or possible leak paths. Tests in our laboratory show that with the use of addition agents the current density may be increased to ten times that which we are now using, without excessive treeing. Unfortunately, the deposit produced at this higher current is porous and brittle, and correct dimensions are difficult to maintain, especially when the copper is fired in a hydrogen atmosphere.

Recent experiments with a 125-gal bath using air agitation enabled us to increase current density to 61 asf without the use of additives or wetting agents. It is interesting to note that no pitting was observed on the lower electroformed surfaces even when the deposit reached ¼-in. wall thickness. Sections made with this procedure were machined, hydrogen-fired, and used in a ceramic assembly under high vacuum without any leakage. As the mandrels used were only 3 in. diameter by 13 in. long, it remains to be seen whether this process may be adapted to accelerator sections 5 ft or more in length.

Much work was carried out in trying to eliminate the passive surface of the copper assembly after electropolishing. A 20 per cent sulfuric acid dip, both at room and elevated temperatures, was tried, as was an acetic acid and cyanide dip; but none proved as satisfactory as the short cathodic treatment in 20 per cent sulfuric acid. As shown in Fig. 10, there is a definite line of demarcation between the deposit and the copper disk when the surface is improperly activated. Fig. 11 shows the elimination of this demarcation line with proper activation.

Various methods of current manipulation were tried, including periodic reverse plating and superimposed AC on DC. Deposits produced by periodic reverse plating produced a laminated structure. The work with superimposed AC on DC was not complete due to improper equipment, but any advantage is questionable.

Accelerators of smaller diameter, 24 in. long, have been formed in which copper plating of the aluminum spacers before assembly was eliminated. The chemically cleaned copper disks and aluminum spacers were stacked on a stainless steel mandrel, and the assembly was electropolished in 65 per cent phosphoric acid solution at 100 asf for 40 seconds. It was then water-rinsed, cathodically treated in 20 per cent sulfuric acid, water rinsed again, and then plated in a pyrophosphate copper bath at 20 asf for 15 min at 130 F at a *p*H of 8. Due to the stress-free property of the pyrophosphate copper deposit there was no premature separation of the copper from the aluminum, and the adhesion of the deposit to the copper disk was excellent. After a water-rinse the assembly was transferred to the acid copper bath for a copper deposit of ¼ in. It is possible that the plating of the aluminum spacers with 0.002 in. of cyanide copper may be eliminated. Much time would be saved if further work proves this to be feasible.

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STUDIES ON ELECTROLESS NICKEL PLATING

by DR. CLARA H. de MINJER* and DR. ABNER BRENNER†

The electroless plating of nickel was studied for both basic and practical purposes. The rate of deposition increased with the pH of the bath, and varied with the nature of the acid used for buffering and/or complexing of nickel ions. Hydroxyacetic and lactic acids yielded the highest rate of deposition. The rate passed through a maximum at a certain concentration of acid. Nickel phosphite precipitated from the bath more readily at higher values of pH.

Outdoor exposure tests were made of steel plated with electroless nickel and with electrolytic deposits of nickel and nickel-phosphorus alloy. The electroless deposits and the electrolytic nickel-phosphorus alloys, both of which contained about nine per cent of phosphorus, gave better protection than electrodeposited nickel.

I. INTRODUCTION

SINCE THE APPEARANCE of the first publication on the electroless plating process about ten years ago,[1] numerous papers and patents have appeared dealing with the practical applications of the process. However, except for the work of Gorbunova and Nikiferova[2] few fundamental studies of the process have been made. In the work reported herein several features of electroless plating were studied for their fundamental as well as practical importance. Special attention was given to the factors influencing the plating rate, and a study was made of the protective value of electroless nickel on steel, since favorable but unsubstantiated claims had been made concerning it.

II. EXPERIMENTAL

Distilled water was used in preparing the baths. Pure chemicals were used for the following reasons. Technical sodium hypophosphite was less satisfactory than the pure material, as baths prepared with the technical product decomposed more rapidly. The technical product contained iron, but this apparently was not the cause of the more rapid decomposition.

Hydroxyacetic acid (glycolic acid), an important constituent of one of the recommended electroless baths, was obtainable as a bulk commercial chemical in the form of a 70-per cent solution. It was unsuitable, as baths prepared from a 70-per cent solution which had been stored for some time yielded a slow rate of deposition of nickel. The acid contained copper and iron, but it is believed that these impurities were not responsible for the poor results with the commercial acid. It is possible that in the solution a self-esterification of hydroxyacetic acid occurred. Filtration through activated carbon did not improve the plating rate. However, crystallization of the commercial solution by cooling it to —20C and then seeding gave a product which was satisfactory. For the experiments reported in this paper, a pure, commercially available hydroxyacetic acid was used.

The composition of the baths used are given in Table I. Bath No. 2 which contains 39 g/l of hydroxyacetic acid will be referred to as the "Hydrac bath," and hydroxyacetic acid will be referred to as "Hydrac." The Hydrac bath will be considered as a reference for comparison with other baths.

For calculation of the thickness of the deposits the density of pure nickel, 8.9 g/cm^3, was used. Since the deposits contained phosphorus, the density was actually less and the thickness values given in the paper may be about 10 per cent low.

The equipment used in these tests was simple. The plating baths, ranging in volume from 150 ml to 6 liters, were contained in beakers. Most of the specimens for plating consisted of panels of low carbon steel, 2.5 by 0.4 by 0.03 in. For the exposure tests, larger panels (4 by 6 in.) were used. All the panels were prepared for plating by the following sequence of operations: degreasing with trichloroethylene, scrubbing with a paste of magnesium oxide, immersion in trisodium phosphate solution, hydrochloric acid 1:1, and concentrated sulfuric acid. Rinsing was performed between each step.

III. INFLUENCE OF *p*H ON THE RATE OF DEPOSITION

The *p*H of the electroless bath is known to affect the rate of nickel deposition. The patents of Gutzeit and Krieg[3] and Gutzeit and Ramirez[4] gave data showing that the rate of

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nickel deposition from the acid electroless bath increased with the *p*H. However, the optimum *p*H for the continued operation of an electroless bath has not been clearly indicated in the literature. Operations of baths at a high *p*H, to take advantage of the higher rate of deposition, is not practicable for two reasons:

(1) The maintenance of the *p*H of the bath at a high value such as 6 is difficult because hydrogen ion is formed in the course of the reaction. The *p*H drops rapidly between 5 and 6 because of the poor buffering characteristics of the organic acid constituents of the bath in this range. The rate of decrease of *p*H diminishes at about 4.5. Maintenance of a bath at a *p*H above 5 requires the continuous addition of alkali. For this reason operation at a lower and less variable *p*H is more practicable.

(2) Another objection to the maintenance of the *p*H of the bath at 5 to 6 is that the solubility of nickel phosphite, which forms as a result of the plating reaction, decreases with increase of *p*H. Precipitation of this compound is undesirable as it initiates decomposition of the bath and gives rough deposits. Therefore, for a long period of operation, the bath must be maintained at the lowest *p*H at which an acceptable rate of plating can be obtained.

Because of the importance of finding an optimum *p*H for operation of the bath, experiments were made on the rate of deposition at various values of *p*H. Since the *p*H changes during operation of the bath, and since in these experiments it was not feasible to regulate the *p*H during the plating operation, a relatively large volume of bath, 1 liter, was used to plate a relatively small specimen, having an area of only 12 cm^2. The panels were plated for one hour.

The relation between rate of deposition and *p*H of the bath was investigated for four different baths, the compositions of which are given in Table I.

The data are graphed in Fig. 1 by horizontal lines representing the average rate of deposition for the indicated change of *p*H in the course of the experiment. The Hydrac baths had the greatest rate of plating. The reference Hydrac bath changed only 0.1 or 0.2 *p*H in the course of an experiment. Its rate of plating decreased rapidly with decrease in *p*H. At an initial *p*H above 5 the rate was about 30 microns per hour (1.2 mils/hr), but at an initial *p*H of 4 the rate had dropped to less than half this. The rate of plating from the low-hydrac bath was less affected by *p*H, and at lower *p*H the rate was higher than obtained with the reference bath. However, the change of *p*H in the course of an experiment was much larger because of the smaller concentration of organic acid present for buffering purposes. The rate of deposition from the citrate baths also decreased to about half when the initial *p*H was changed from 5.5 to 4.5. The rates were much lower than those of the hydrac baths, being less than a fourth as great. The presence of acetate in the citrate bath decreased the drop in *p*H on operation, but did not affect the rate of deposition of nickel.

The sensitivity of the rate of deposition of electroless nickel to *p*H may explain the observation of Brenner and Riddell[1b] that agitation of an acid electroless bath increased the rate of deposition. Because of the production of hydrogen ion, by the reaction, the *p*H of the solution at the surface of an actively plating specimen must be lower than that of the body of the bath. Agitation of the bath reduces the thickness of the diffusion layer on the specimen and brings the *p*H of the solution at the specimen-solution interface closer to that of the body of the bath.

IV. INFLUENCE OF THE ORGANIC ACID ON THE RATE OF DEPOSITION

Brenner and Riddell had noted that the rate of deposition of electroless nickel was affected by the type of organic acid used and its concentration. Subsequently, a patent of Gutzeit and Ramirez[4] claimed that certain dibasic acids, for example succinic acid, considerably increased the rate of deposition of electroless nickel.

Since the type of organic acid appeared to be an important variable, the subject was studied in some detail. The baths were operated at an initial *p*H of 4.2 to 4.3 and at the boiling point. The data in Fig. 2 shows that the rate of deposition of nickel passed through a maximum at a certain concentration of organic acid. In general at this concentration the brightness of the deposits reached a maximum. A comparison of the maximum rates of deposition obtained with the

TABLE I

COMPOSITIONS OF ELECTROLESS PLATING BATHS. ALL BATHS OPERATED AT 95 TO 100C. pH OF ACID TYPE OF BATHS 4.0–4.3, ADJUSTED WITH SODIUM HYDROXIDE. pH OF ALKALINE BATHS 8.5–9.5, ADJUSTED WITH AMMONIUM HYDROXIDE

	1	2	3	4	5	6	7	8
	Inorganic Bath	Hydrac (reference) Bath	Low-Hydrac Bath	Citrate Bath	Citrate-Acetate Bath	Succinate Bath	Alkaline Bath	Alkaline Bath with Wetting Agent*
Bath Constituents								
g/l $NiCl_2 \cdot 6H_2O$	30	30	30	30	30	22	30	30
$NaH_2PO_2 \cdot H_2O$	10	10	10	10	10	30	10	10
Hydroxyacetic acid	—	39	25	—	—	—	—	—
Succinic acid	—	—	—	—	—	15	—	—
Sodium citrate	—	—	—	15	15	—	100	100
Sodium acetate	—	—	—	—	5	—	—	—
NH_4Cl	—	—	—	—	—	—	50	50

* Neccanol EP, 0.1 g/l, Product of National Aniline Division of Allied Chemical & Dye Corp.

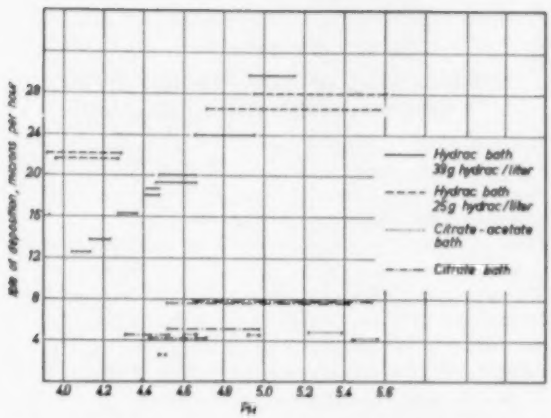

Fig. 1. Variation of rate of deposition of electroless nickel with pH, and decrease in pH of electroless baths on operation. The length of a horizontal line represents the change in pH during an experiment. The ordinate of the line represents the average rate of deposition corresponding to the pH range indicated by the length of the line.

different acids shows that lactic acid gave the fastest rate and hydrac next. The succinic acid bath did not deposit nickel as fast as the other two, and the permissible range of acid concentration for the optimum rate was more limited. The bath with tartaric acid yielded the slowest rate of deposition.

The large difference in the maximum rates of deposition of nickel in the presence of the various acids points to a specific influence of the acid on the reaction. Since the acids do not change the chemistry of the reaction, they may exert their effects through adsorption on the active nickel surface. The maximum in the rate curve can be explained on the basis that a low adsorption of the acid accelerates the reaction whereas a high adsorption poisons the surface.

There are other possible explanations. The steep rise of the curve occurring with the small concentrations of acid, for example zero to 10 g/l, might be due to the improved buffering of the bath. During operation of baths containing less than 5 g/l of acid, the *p*H decreased to about 3. This lowering of the *p*H was at least partly responsible for the lower rate in baths of low acid concentrations. However, an explanation based on *p*H is inadequate to explain the decrease in rate for acid concentrations beyond the maximum, inasmuch as beyond this point the *p*H of the bath changed very little in the course of the experiment. Moreover, a comparison of Fig. 3 with Fig. 2 shows that the relative buffering power of the acids does not parallel the rate of deposition of nickel obtained with them.

The decrease in rate of deposition to the right of the maximum and the variations in the maximum rates obtained with different acids might be explained on the basis of the formation of nickel complexes. Acids like hydrac, lactic and citric acids form complexes with nickel. However, succinic acid does not and this acid has also a maximum rate in its curve.

The effect of the various acids on the stability of the baths was also noted. The stability of the bath was evaluated qualitatively by comparing the different baths with respect to the amounts of nickel spontaneously deposited on the bottom of the beaker and with respect to the precipitation of nickel compounds.

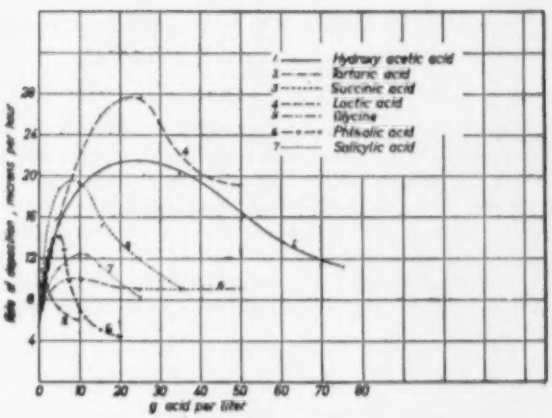

Fig. 2. Relationship between concentration of organic acid and rate of deposition of electroless nickel.

Hydroxyacetic Acid (Hydrac)

Hydrac was preferred by Brenner and Riddell for the acid electroless bath. The higher rate of plating and the smaller effect of acid concentration on the plating rate shown in Fig. 2 supports this choice. The original recommendation was for a concentration of sodium hydroxyacetate of 50 g/l which is equivalent to about 39 g/l of the acid. Fig. 2 shows that a concentration of 25 g/l of the acid gives a slightly higher rate. The influence of *p*H on the rate in this "low hydrac" bath is smaller and the deposit is brighter. However, a disadvantage is the lower solubility of nickel phosphite which tends to precipitate sooner and shortens the life of the bath.

One of the problems in the operation of the hydrac bath is that the rate of plating decreases after the bath has been used a relatively short time. The cause of this has not yet been found, but might be related to the self-esterification of the acid. A solution of this problem would be of considerable value to the practical application of electroless plating.

Lactic Acid

Lactic acid was chosen for study because it is the next homologue of hydrac. The maximum rate of deposition was higher than that of hydrac. However, the bath was not as stable and the deposits were rougher. The possibility exists

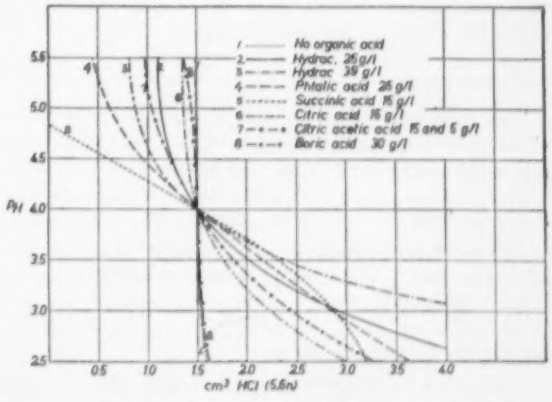

Fig. 3. Variation of pH of various electroless nickel baths on addition of acid.

of improving this bath so as to take advantage of its high rate of deposition.

Acetic Acid

Experiments with acetic acid confirmed the conclusion of Brenner and Riddell that such baths are not stable. Baths containing sodium acetate, 50 g/l, decomposed within 20 minutes. The addition of acetate, 5 g/l, to a hydrac bath did not influence the rate of deposition from the latter. In some baths used commercially, acetate is added to a citrate electroless bath for the purpose of maintaining the rate of deposition. A citrate bath without acetate decreases in rate of deposition as it ages.

Citric Acid

Citric acid is the organic hydroxy acid most commonly used in electroless plating baths, although it yields a rate of deposition less than half (about 7 microns per hour) that of the hydrac bath. The reason for the extensive use of the inferior citric acid is that hydrac is not readily available in the pure form. The addition of hydrac to an electroless plating bath containing citric acid, 15 g/l, raised the rate of deposition to about 11 microns per hour, which, however, was still not as high as that of the pure hydrac bath.

Succinic Acid

Succinic acid yielded a rate of deposition of nickel slightly lower than that of the hydrac bath. Also, the stability of the bath was lower probably because of the lower solubility of nickel phosphite in the bath. Under the conditions of our experiments, the stability of the bath and the rate of deposition were lower than claimed in the patent of Gutzeit and Ramirez.[4] Succinic acid added to a citrate bath increased the rate of deposition only very slightly, to about 8 microns per hour.

Tartaric Acid

Fig. 2 shows that tartaric acid does not yield a very high rate of deposition. At a concentration of 25 g/l a light green precipitate forms.

Glycine

The addition of glycine to the electroless plating bath turned it slightly bluish, indicating the formation of a complex. Fig. 2 shows that the rate of deposition was about 10 microns per hour, hence about half that of the hydrac bath. However, the rate did not change appreciably with the concentration of glycine and the bath was very stable.

Phthalic Acid

This acid was chosen because of its excellent buffering characteristics at a *p*H of about 4. Fig. 2 shows that it had a moderate rate of deposition. The bath was not very stable.

Salicylic Acid

This acid was chosen as a representative of aromatic α-hydroxy acids. The results were similar to those obtained with phthalic acid.

Substituted Acetic Acids

Wieland and Franke[5] found that certain β-hydroxyacids accelerated the oxidation of hypophosphite by oxygen in the presence of an iron salt. Because of this specific behavior, it was of interest to investigate the behavior of these acids in the electroless plating bath. Oxalacetic acid and benzoylacetic acid were prepared from their esters[6] and introduced into the electroless plating bath. These acids had no effect on the rate of deposition. This may have been because the acids hydrolyzed at the elevated temperature used in the experiments.

Other Acids

Electroless plating baths were made up with nickel perfluoroacetate and nickel perfluorobutyrate, 0.125 molar, in place of nickel chloride. Some of the baths contained hydrac, others did not. The rate of deposition and the stability of the baths was about the same as those made with nickel chloride. Boric acid, also, had no influence on the rate of electroless plating. Diglycollic acid, which consists of two molecules of hydrac joined through an oxygen linkage, yielded a plating rate about two-thirds of that given by hydrac.

TABLE II

COMPOSITION OF THE PRECIPITATES IN WEIGHT PERCENTAGES, AIR DRIED

	1	2	3
Nickel	28.9	27.4	25.8
Phosphite (PO_3)	39.6	35.5	31.5
Hypophosphite (PO_2)	nil	nil	2.6
Total P	16.7	15.9	13.8
Water***	21.9	22.1	—*
Chloride	1.2	0.9	0.3
Sodium	—*	—*	6.5
Summation for all constituents except total P	91.6	85.9	70.2**

* Not determined.
** Without water.
*** Determined by heating at 200C.

V. PRECIPITATE FORMED IN ELECTROLESS PLATING BATHS

A. Composition

After an electroless plating bath has been operated for a time, a green precipitate forms in the bath. This precipitate is undesirable, because it initiates nucleation of nickel and causes spontaneous decomposition of the bath. A study was therefore undertaken of the nature of this precipitate and methods of preventing its formation.

The precipitate was less soluble in a hot than in a cold bath and frequently a turbid bath would become clear on cooling and standing. Several samples of the precipitate were collected for examination. The wet precipitates were light yellow-green and became a darker green on drying. They were analyzed after air drying. The analyses of the precipitates are given in Table II.

The total phosphorus contents of the air dried precipitates No. 1 and No. 2 were one to two per cent higher than the phosphorus content corresponding to the phosphite content. On the assumption that the phosphorus in excess of PO_3^{--} was phosphate, the precipitates No. 1 and No. 2 contained about 4 and 6 per cent of phosphate, respectively. The total phosphorus content of precipitate No. 3 agreed with the sum of the contents of phosphite and hypophosphite.

The water contents of samples 1 and 2 in Table II were based on weight losses obtained on heating at 200C. The

ratio of H_2O to phosphorus or nickel in these samples is between 2 and 3. Not very much weight can be given to the analysis of the water content, since the water content of the samples appeared to depend on the temperature at which the samples were heated.

The most significant fact concerning the composition of the precipitates is that the ratio of nickel to phosphite is approximately 1:1. This excludes the possibility that the precipitate could be a mixture of sodium phosphite and a nickel phosphite. Two nickel phosphites are mentioned in the literature, $NiHPO_3 \cdot H_2O$ and $NaNiPO_3$. The precipitate may consist of a mixture of these two salts. The fact that sample 3 contained sodium lends support to this view. The other two samples were not analyzed for sodium.

The precipitates 1 and 2 were analyzed after ignition at 700C. The composition corresponded approximately to $Ni_2P_2O_7$, but the nickel content was a little low, probably because of the presence of some $Na_4P_2O_7$. The following reaction is given in the literature[7] for the thermal decomposition of nickel phosphite:

$2\,NiHPO_3 \cdot H_2O \rightarrow Ni_2P_2O_7 + 2\,H_2 +$ trace nickel phosphite.

B. Effect of Phosphite ion on Precipitation

The concentration of phosphite ion in the electroless bath builds up on continued operation, and also the *p*H of the bath changes. Both of these variables of composition affect the solubility of nickel phosphite. Information on the solubility of this salt in the electroless plating bath is of importance for practical plating, since trouble-free operation can be expected only up to the point that the bath becomes saturated with the salt.

The incipient precipitation of the salt at the boiling temperature was, therefore, investigated in baths of various *p*H and phosphite concentration. All the baths contained $NiCl_2 \cdot 6H_2O$, 30 g/l and NaH_2PO_2, 10 g/l. Some of the baths contained only these inorganic salts, others contained citric acid or hydrac. Phosphite ion was introduced into the baths in the form of phosphorous acid. Saturation of the bath with nickel phosphite was determined by boiling for 30 minutes and observing whether a turbidity developed. At higher *p*H the determination of the phosphite concentration at which the turbidity developed was difficult, and consequently, the results were not very accurate.

The steepness of the curves in Fig. 4 show that the solubility of nickel phosphite decreases rapidly with rise of *p*H, an increase of 1 *p*H greatly lowering the solubility. The bath containing no organic acid, curve 1, at a given *p*H dissolves less nickel phosphite than the baths containing organic acids, curves 2 to 4. The reference hydrac bath (curve 3) has a greater solubility for the phosphite than the citrate bath, curve 2. The low hydrac bath was not studied. Comparison of curve 4 with 3 shows that a concentration of hydrac higher than in the reference bath, still further increased the solubility of nickel phosphite. The curves for each of the baths has a sharp bend. The center of this bend may be arbitrarily taken as the limiting *p*H above which the bath should not be operated. The values of the *p*H for the different baths are as follows: bath without organic acid, about 3.5; citrate bath, 4.2; reference hydrac bath, 5.0; concentrated hydrac bath, 5.7.

VI. EFFECT OF IRON OR COPPER SALTS ON THE OPERATION OF THE BATH

The electroless plating bath is very sensitive to impurities. Some of the compounds used for making up the baths contained iron and/or copper. These elements have been blamed for low plating rate and instability of the bath. A few experiments were made to determine the extent to which small contents of these impurities affected the operation of the hydrac bath (Table I, bath 2). Ferrous chloride 0.5 g/l, decreased the rate of deposition of nickel from the initial rate of 21 to a final rate of 16 microns per hour. The effect of iron on the stability of the bath was examined by boiling the baths for several hours. No decrease in stability was observed.

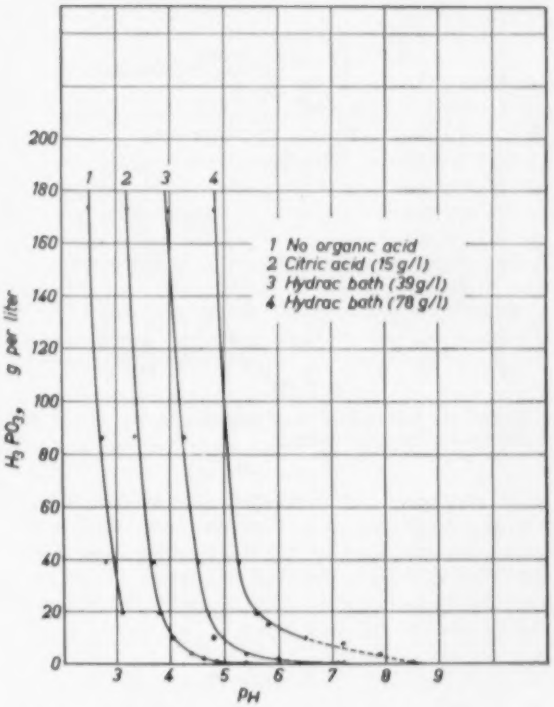

Fig. 4. Solubility of nickel phosphite in solutions of various pH in the presence of phosphite ion.

The effect of copper was examined in the hydrac bath containing $CuSO_4 \cdot 5H_2O$, 4 g/l. Copper deposited on a steel panel as soon as it was immersed in the bath, and on longer plating a dark, rough powdery nickel deposit was obtained. The nickel coatings obtained on subsequent panels were of normal appearance and deposited at the normal rate. Apparently the copper was quickly removed from the bath. The results of these experiments with iron and copper indicated that these metals are not seriously detrimental to the operation of the electroless plating bath.

VII. ATTEMPTS TO REACTIVATE SPENT BATHS

In the plating process hypophosphite is consumed, and to maintain a bath in continuous operation a solution of hypophosphite is added at intervals. Recently patents[8] were issued for the use of ion exchange resins for replacing phosphite in the bath by hypophosphite.

An attempt was made to rejuvenate the bath by electrolytically reducing phosphite to hypophosphite. The anode was separated from the cathode by a porous diaphragm. Metals having a high hydrogen over-voltage, such as mercury, zinc or cadmium, were used as cathodes. Nickel or platinum was used as anodes. Experiments were made both with an

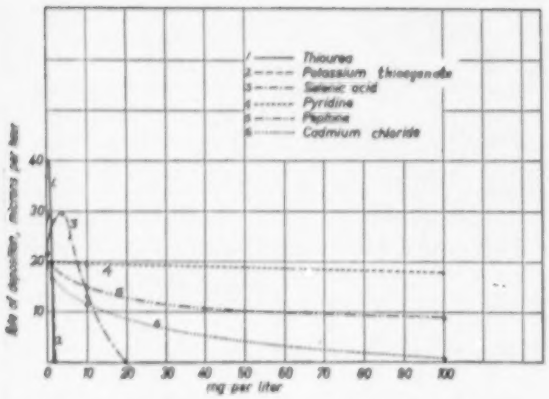

Fig. 5. The influence of some inhibitors on the rate of deposition of electroless nickel.

electroless plating bath containing phosphite and with pure solutions of phosphorous acid and phosphite at various *p*H. No hypophosphite was formed in these experiments. However, the experiments were not exhaustive and the probability still exists of developing an electrolytic method of rejuvenating the electroless bath.

VIII. EFFECT OF INHIBITORS AND OTHER SUBSTANCES ON RATE OF NICKEL DEPOSITION

Several hypotheses have been advanced to explain the mechanism of electroless plating. These generally incorporate the idea of an initial discharge of hydrogen which in the presence of nickel as catalyst reduces nickel ion to nickel. One of the authors has advanced a slightly different hypothesis in which a two-step process is envisioned. The first step is the catalytic decomposition of hypophosphite ion leading to the discharge of hydrogen. The second step involves a transfer of energy from the discharging hydrogen ion to the nickel ion thereby activating it so that it can react with the hypophosphite ion. The difference between this hypothesis and the others is that the hydrogen only takes part in the process to effect an activation; it does not chemically bring about the reduction of nickel ion to nickel. The details of the application of this hypothesis were treated elsewhere[9] and only one aspect of the hypothesis is treated here.

On the basis of the hypothesis, the rate and manner in which hydrogen is discharged in step 1 is a factor in determining the rate and efficiency of nickel deposition in step 2. The hydrogen over-voltage on a metal surface may be taken as a measure of the ease of hydrogen discharge on a surface—the discharge, whether chemical or electrochemical, occurring more readily on a surface of low hydrogen overvoltage. By analogy, step 1 presumably should occur more readily on a surface of low hydrogen overvoltage.

However, according to step 2, the hydrogen discharge must be capable of activating the nickel reaction. By analogy with reductions involving the evolution of hydrogen, it seems reasonable that hydrogen should possess more energy for activation of the reaction of nickel with hypophosphite ion if discharged on a surface of high hydrogen overvoltage, and that it would possess the minimum available energy for activation if discharged at its reversible potential. Thus the conditions for optimum activation of the reaction of nickel ion with hypophosphite ion are the opposite of those for the discharge of hydrogen. Consequently, there should be some intermediate degree of hydrogen overvoltage which should yield the maximum rate of deposition.

The idea that there should be a relation between hydrogen overvoltage and the efficiency and/or rate of the electroless process lead to a study of the effect on electroless plating of dissolved substances that affect hydrogen overvoltage. Bockris and Conway[10] and Misch and Bernstein[11] have shown that very small concentrations of some substances have an effect on hydrogen overvoltage. A rather heterogeneous group of substances called inhibitors are supposed to exert their effect through increasing hydrogen overvoltage.

A study was made of the effect on electroless plating of several organic and inorganic substances, which are known to affect hydrogen overvoltage. The low-hydrac bath, Table I, No. 3, was used for these experiments which were made at about 100C. The initial *p*H of the bath was 4.2 to 4.3 and at the end of the reaction it was about 4.0.

The effects of various substances on the rate of electroless nickel plating are shown in Figs. 5 and 6. The most interesting results are those obtained with thiourea, selenic acid, and potassium thiocyanate. The rate of deposition of nickel was increased markedly by potassium thiocyanate and thiourea in concentrations of about 0.5 mg/l, that is a concentration of about 0.5 ppm of solution. With thiourea the rate reached a maximum of about twice that of the corresponding bath without thiourea. The maximum obtained with KSCN and thiourea was very sharp, as a concentration of over 1.5 mg/l resulted in inhibition of plating. The maximum yielded by selenic acid was somewhat broader, occurring at a concentration of about 4 mg/l. Pyridine had little effect on the rate of deposition, whereas cadmium chloride caused the rate of deposition to fall off steadily with concentration and to become about nil at a concentration of about 100 mg/l.

A few experiments were also made with miscellaneous other substances. Arsenic trioxide, 10^{-4} normal, had little effect on the rate of deposition, but a concentration of 10^{-3} normal practically inhibited deposition. Benzene disulphonic acid had no effect on the rate of deposition. Ethyl alcohol, 50 ml/l, had no influence on the rate of deposition of nickel from the bath containing hydrac, but interfered with deposition from a bath containing only nickel salts and hypophosphite. Sometimes only hydrogen and no deposit was obtained, in others a deposit was obtained after long immersion.

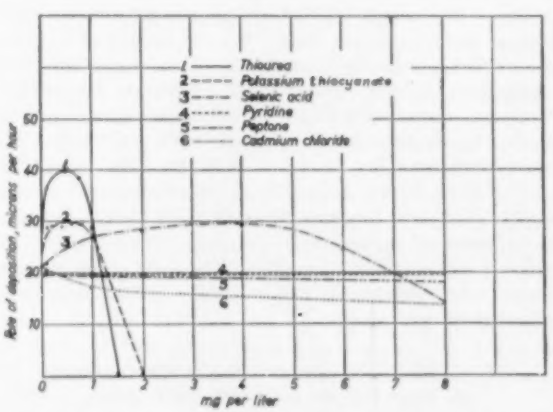

Fig. 6. Same as Fig. 5, except the abscissas are on a larger scale.

TABLE III
SUMMARY OF EFFECT OF ADDITION AGENTS

Inhibitor	Rate of Deposition	Brightness	Stability
Selenic acid	Increases to a maximum	Improved	No influence
Thiourea	Increases to a maximum	Improved	Improved
Potassium thiocyanate	Increases to a maximum	Mat	No influence
Peptone	Decreases	Improved	No influence
Pyridine	Decreases	Improved	No influence
Cadmium chloride	Decreases	Improved	No influence
Benzene disulfonic acid	No influence	Improved	No influence

The various additions to the bath had other effects besides altering the rate. Some brightened the deposit, others made it dull. Thiourea was exceptional in that it increased the stability of the bath. No nickel deposited on the bottom of the beaker after long operation. The effects of the various addition agents are summarized in Table III.

Recently a patent was issued to Talmey and Gutzeit[12] covering the use of sulfides and other substances for stabilizing electroless plating baths.

The thiourea addition was of most interest because of its large effect in considerably increasing the rate of deposition. The rate of deposition of nickel from a bath containing 1 mg/l of thiourea, however, gradually decreased with use of the bath, and the deposits lost their brightness, becoming milky. This decrease in rate may be due to the production of deleterious decomposition products, to the gradual decomposition of thiourea, or to its removal from solution by adsorption on the metal. The second reason is probably the most likely, as shown by the following experiments. A bath containing 1.5 mg/l of thiourea did not plate. After standing for about one week a high plating rate of 38 microns of nickel coating per hour was obtained. These experiments indicate that some of the thiourea had disappeared and the concentration had dropped to the optimum for plating. In another experiment 1 mg/l of thiourea was added and after each hour of plating 0.5 mg/l of thiourea was added. In this manner a plating rate of more than 40 microns per hour was maintained for several hours. The brightness of the deposits decreased a little. The concentration of thiourea is very critical, and this makes it difficult to use in the practical operation of a commercial electroless plating bath. However, it is likely that a thiourea derivative or some other sulfur compound can be found which will give a high plating rate and a broad maximum like that obtained with selenic acid.

To study the mechanism of the effect of thiourea, measurements were made of the dynamic electrode potentials of an electroless hydrac nickel bath containing 0.5 mg/l of thiourea. At room temperature the plot of current density vs potential for the bath containing thiourea was, within the limits of reproducibility, similar to that of the reference bath. Another series of experiments was made in which an electrolysis was carried on at a constant current density and thiourea added in increments. The reproducibility and consistency of the measurements were not satisfactory and no conclusions could be drawn.

A series of measurements were made of the static potential of a specimen immersed in an electroless plating bath at the boiling point. Thiourea was added in increments. The changes of potential were small until the concentration of thiourea reached 1.2 to 1.6 mg/l. At this concentration the reaction stopped as was evidenced by the cessation of hydrogen evolution, and the potential of the electrode became about 0.1 volt more noble. Further additions of thiourea had little effect on the potential. It has already been shown (1 b) that the potential of an actively plating specimen changes to a more noble potential when the bath is poisoned so that deposition ceases.

These measurements of potential do not support or disprove the hypothesis which has been advanced, and they do not throw any light on the reason for the higher rate of deposition of nickel in the presence of small concentrations of thiourea.

IX. COMPARATIVE OUTDOOR EXPOSURE TESTS OF COATINGS OF ELECTROLESS NICKEL, ELECTRODEPOSITED NICKEL, AND ELECTRODEPOSITED NICKEL-PHOSPHORUS ALLOYS ON STEEL

Mainly on the basis of salt spray tests, it has been claimed that electroless nickel affords steel more protection than electrodeposited nickel. Since accelerated tests frequently do not agree with outdoor tests, a small number of outdoor exposure tests were made to compare the protective value of electroless nickel deposits with that of electrodeposited nickel and nickel-phosphorus alloys. The panels were exposed at two locations, Kure Beach, North Carolina and Washington, D. C.

Preparation of Specimens

Two types of low carbon steel specimens were used; a cold rolled steel with a smooth semi-bright surface and a steel with a pebbled surface, similar to that of a hot rolled steel. The specimens were flat rectangular panels, 4 by 6 in., and about 0.03 in. thick. Prior to plating the specimens were cleaned as described in Section II.

Four different electroless plating baths, the compositions of which are given in Table I as No. 2, 6, 7 and 8, were used for preparing the coatings. Both alkaline and acid types of electroless baths were included. The succinic acid bath was used because it had been described in a recent patent.[4] One of the alkaline baths, No. 8, contained a wetting agent to diminish the pitting that occurred with bath No. 7.

The compositions of the baths used for electrodepositing coatings are given in Table IV. Since previous studies[13] had shown that the corrosion resistance of the electrodeposited nickel-phosphorus alloys[14] increased with their phosphorus content, coatings of two different phosphorus contents, 3 and 9 per cent, were electroplated. The nickel coatings were plated from a conventional all-chloride bath.

The electroless plating was done at a temperature of 94 to 98C in 6-liter baths with electrically heated walls and bottom. Three specimens were plated at the same time. The bath was agitated with air and the composition and *p*H of the baths were maintained by periodic additions of alkali and sodium hypophosphite. The average rate of plating was about one-third mil per hour which is somewhat lower than

TABLE IV

COMPOSITION AND OPERATING CONDITIONS FOR THE ELECTROLYTIC BATHS

Composition, g/l	All Chloride Bath	Ni-P Baths	
		3% P Alloy	9% P Alloy
$NiCl_2 \cdot 6H_2O$	240	40	40
$NiSO_4 \cdot 7H_2O$	—	160	160
$NiCO_3$	—	20	40
H_3BO_3	30	—	—
H_2PO_4	—	50	50
H_3PO_3	—	5.4	44
Naccanol EP	—	0.1	0.1
*p*H	2.0 to 2.5	2	0.5 to 1.0
Temperature, °C	43	85–90	85–90
Current density, amp/dm²	4.5	5	5

the rates obtained with the freshly prepared baths described in the preceding section.

Two thicknesses of coating were plated, 0.5 and 1.0 mil nominal thickness. The thicknesses were calculated from the weight of coating deposited. With a few exceptions, duplicate specimens of each thickness of coating were exposed at each location.

Appearance and Phosphorus Content of Coatings as Deposited

The electroless deposits from the hydrac and succinic acid baths were bright with a few streaks. The phosphorus content was 9–10 per cent. The deposits from the alkaline bath were bright and had areas with small pits. The deposits from the alkaline bath with wetting agent were dull and also contained areas with small pits. All the deposits from alkaline baths contained 7 to 8 per cent phosphorus. The electrodeposited alloys containing about three per cent of phosphorus were dull, the alloys containing about 9 per cent of phosphorus were bright. The electrolytic nickel deposits were dull and gray.

Conditions of Exposure and Rating of Panels

The specimens exposed in Washington, D. C. were mounted on porcelain insulators on racks on the grounds of the National Bureau of Standards. The racks were inclined 30° from horizontal and faced south. The racks at Kure Beach were similar and faced the ocean, at a distance of 800 feet from the shore-line.

The ASTM rating system was used. The ratings were based on the area of surface covered with rust. A rating of 10 indicates no rust and a rating of zero indicates over 50 per cent of rust. Judging the panels was difficult in some instances, because some of the coatings containing phosphorus were stained or darkened, and it was difficult to distinguish between stains and rust. The panels were rated at intervals of a few months and the tests were concluded after 14 to 15 months.

Exposure Tests

The results of the exposure tests and the salt spray tests are summarized in Table V. The main conclusion to be derived from the exposure tests is that electroless nickel deposited from acid baths afforded far more protection to steel than electrodeposited nickel (compare No. 1, 2, and 3 with 10 and 11). A coating of electroless nickel 0.5 mil thick yielded better protection than 1 mil of electrodeposited nickel (compare No. 1 with No. 11). Electroless deposits obtained from ammoniacal baths yielded much poorer protection than those from the acid baths (compare No. 4 to 7 with No. 1 to 3), and are on a par with electrolytic nickel deposits. After a short time of exposure these deposits showed blue and brown stains, difficult to distinguish from rust. There was no correlation of visible pits with rust spots.

The electrodeposited nickel-phosphorus alloys containing about 9 per cent of phosphorus were equivalent to the deposits from the acid hydrac bath in protective value. The electrodeposited nickel-phosphorus alloys of low phosphorus content afforded less protection than the high-phosphorus alloy, but yielded better protection than electrodeposited

TABLE V

SUMMARY OF CORROSION TESTS ON STEEL PANELS PLATED WITH COATINGS OF ELECTROLESS NICKEL, ELECTRODEPOSITED NICKEL-PHOSPHORUS ALLOYS, AND ELECTRODEPOSITED NICKEL

Specimen			Rating			
			Kure Beach		Wash., D. C.	Salt Spray
No.	Origin of Coating	Thick mil	4 mos.	15 mos.	14 mos.	8 days
	Electroless Deposits					
1	Hydrac bath	0.5	8.5	4.5	8	9
2	Hydrac bath	1.0	9+	9	9	9
3	Succinic acid bath	1.0	—	9	9	10
4	Ammoniacal; no wetting agent	0.5	2	1	2	5
5	Ammoniacal; no wetting agent	1.0	3	3	2	6
6	Ammoniacal; + wetting agent	0.5	1	0	1.5	3.5
7	Ammoniacal; + wetting agent	1.0	2	2	8.5	7.5
	Electrolytic Deposits					
8	Nickel-phosphorus, 3% P	1.0	9+	5	9	4
9	Nickel-phosphorus, 9% P	1.0	9+	9	9	9
10	Nickel; all chloride bath	0.5	0.5	0	1	3
11	Nickel; all chloride bath	1.0	3	1	3	3.5

nickel. The low phosphorus alloy darkened on exposure more than the high phosphorus alloy.

Those panels which received a high rating of 9 were not necessarily of equally good appearance. All the panels were tarnished or stained, and some were very dark. The coatings, 1 mil thick, of electroless nickel, No. 2 and 3, and the high-phosphorus alloy deposits, No. 9, were tarnished the least and with a little abrasive cleaning could be restored to their original appearance. The panels of these groups exposed in Washington, D. C. still retained a considerable amount of their original brightness.

Some of the coatings plated on the pebbled steel had a slightly higher rating than those plated on the smooth steel.

The results of the salt spray test paralleled those of the outdoor exposure tests, but the discrimination between the specimens was not as sharp as in the outdoor exposure tests.

CONCLUSIONS

1. The deposition rate of electroless nickel plating increased with the amount of organic acid to a maximum, then decreased. Of the organic acids studied lactic acid gave the highest rate, followed by hydroxy acetic acid. The latter gave a more stable bath than lactic acid. Succinic acid gave a lower rate than hydroxy acetic acid.
2. The electroless bath with hydroxy acetic acid recommended in the literature contained 39 g/l of this acid. A smaller amount, 25 g/l gave a higher rate of deposition, was less sensitive to *p*H and yielded brighter deposits. However, the solubility of nickel phosphite in this bath was lower and this shortened the life of the bath.
3. Some inhibitors in very small concentrations (0.1 to 4 mg/l) appreciably increased the rate of deposition; slightly higher concentrations decreased the rate, and still higher concentrations prevented deposition. Examples of these inhibitors are thiourea, potassium thiocyanate and selenic acid.
4. During operation phosphite was formed in the bath. After a certain concentration was reached nickel phosphite precipitated. The solubility of this salt decreased with temperature and with *p*H. Therefore, it is preferable to operate an acid bath at *p*H between 4 and 4.5.
5. Coatings of nickel-phosphorus alloys with 8 to 10 per cent of phosphorus, obtained either electrolytically or by the electroless process from an acid bath, protected steel against rusting better than electrodeposited nickel coatings.
6. The tarnish resistance of these nickel-phosphorus coatings was much better than that of normal dull nickel plates or nickel-phosphorus alloys with a low phosphorus content.
7. Electroless coatings from alkaline baths had protective properties inferior to those from acid baths.

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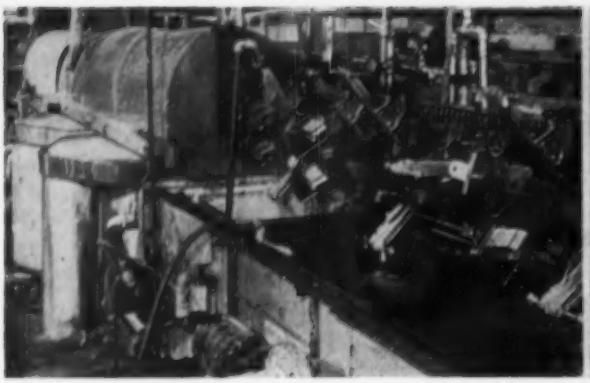
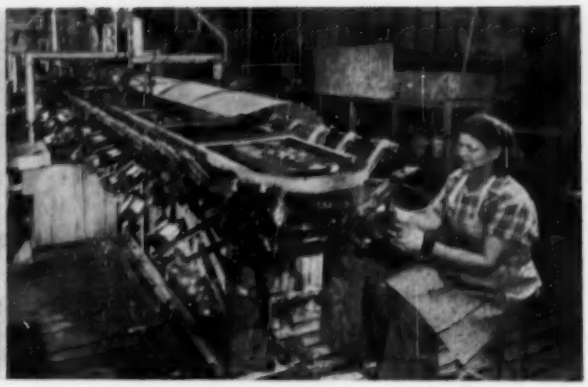
Dr. Abner Brenner received a BA degree in 1929 from the University of Missouri, MS degree from the University of Wisconsin 1940 and PhD degree from the University of Maryland in 1939. He has been on the staff of the National Bureau of Standards since 1930 and is Chief of the Electrodeposition Section. Brenner has twice received the Proctor Award of the AES and has also received the Department of Commerce Award for Meritorious Service. He is a member of the ACS, AES, Electrodepositors Technical Society, Electrochemical Society, Washington Association of Scientists, Phi Beta Kappa and Sigma Xi.



The cleaner tanks, spray rinse, and muriatic acid tank. Note the exhaust stacks leading into the floor.



The loading and discharge end of the machine. The work being run is a C21 square indoor bracket.

Increased Production at Lower Cost Through Automation

"By replacing our old hand-operated plating line with an automatic plating machine,* we were able to double the number of parts plated per hour," states J. A. Weaver, plant superintendent, Hill Plating Company, Long Beach, California. "The machine has lowered our unit plating cost by approximately 20 per cent."

The Hill Plating Company is operated in conjunction with the Coronado Manufacturing Company, producers of component parts of lighting fixtures, which are plated by Hill. The machine was purchased in December of 1955 and installation was completed in mid-June, 1956. Prior to that time, all parts were hand plated, each employe carrying two racks at a time. The average production was limited to about 100 racks per hour, or 600 to 800 parts. The total distance covered by each employe per round was about 40 feet, using ten tanks arranged in a U-form.

"The hand-operated line wasted a great deal of solution," commented Mr. Weaver. "Our loss from drag-out was $15 per day. This was reduced 50 per cent by the plating machine.

"Due to the fact that our business is extremely seasonal, we experience a rush period from June to September. In the past, we had to meet production requirements during that season by hiring more employes to work a night shift. The result was about $300 per week in additional wages."

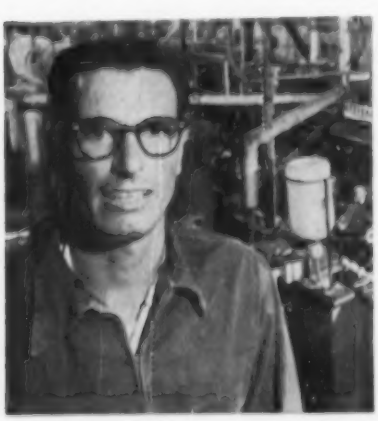
Hill Plating considered buying an automatic machine for about three years. While looking around for a suitable model, they were attracted to an advertisement in an industry publication and decided that the machine advertised was suited to their operation.

"The machine has a capacity of 105 arms, but the larger parts require spacing the racks every other arm. With the hand-operated system, we were using 36 in. racks, but the machine uses 18 in. racks, which means fewer parts per rack. However, the machine handles 300 racks per hour (average), operating on a ten-minute cycle.

"The Coronado Manufacturing Company turns out about 40 different components for lighting fixtures, which are sold to manufacturers for assembly," added Mr. Weaver. "About 30 of these components require plating, since they are made of steel, which is too dull and cold for this type of fixture. By plating the parts with brass, copper or chrome, we increase their attractiveness and saleability.

"The components manufactured here include ceiling brackets which vary in size from 3 in. in diameter to a 10 in. pan, wall brackets, and canopies (which house the

* Frederic B. Stevens "Little Steve" Automatic Plating and Processing Machine.



Jerome A. Weaver, Hill Plating's plant superintendent.

electrical box in the ceiling). The number two or three finish steel is 0.018 to 0.030 in. thick, and the nickel undercoating is about 0.0035 in. maximum thickness. The brass, copper and chrome plate is practically unmeasurable. The parts vary considerably in shape and size, including cylindrical, rectangular, U-shaped, L-shaped and T-shaped parts. A typical part weighs about four ounces."

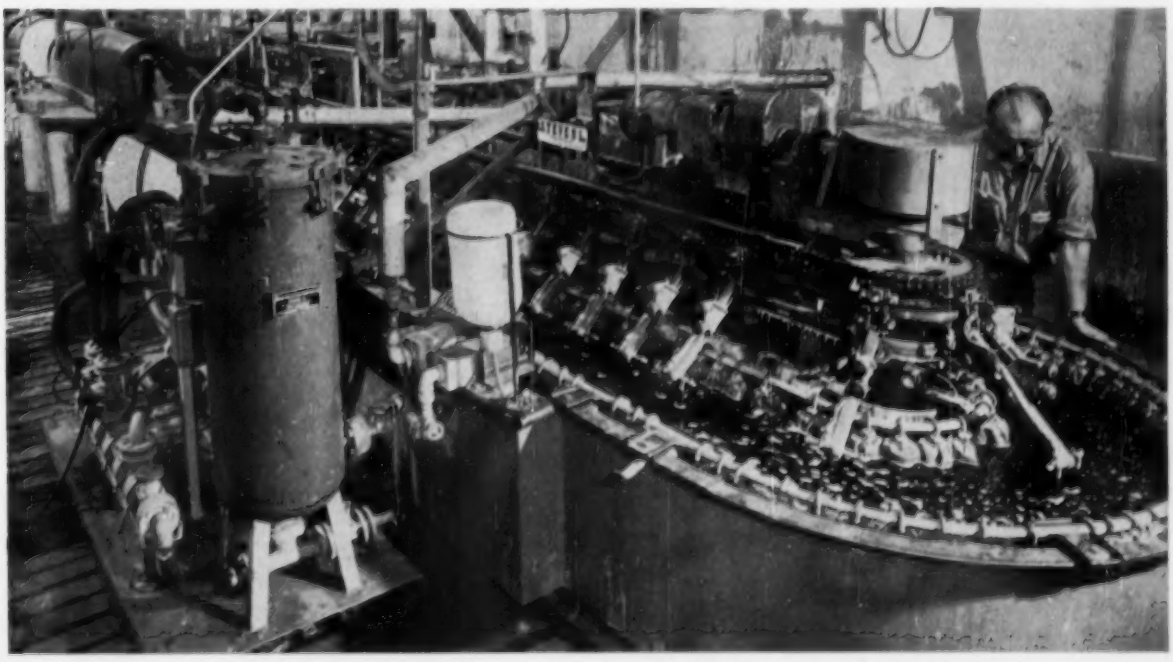
The plating sequence followed by the automatic plating machine at Hill begins with an electrolytic cleaner bath, followed by a spray cleaner, another cleaner bath, and a spray rinse, to remove the soils. A muriatic acid bath is followed by a water rinse, the nickel plating tank and then chrome or brass plating. Two rinses followed by a spray rinse and a hot water rinse before the parts are removed from the hanger arm.

Hill uses the same tank for both brass and copper, and the solution not in use is stored in barrels. The average square inches of plating surface per rack is 150, and the plating time varies due to the solution temperatures, current density applied in the nickel tank (as required by the part shape), and the part size. The majority of the parts are perpendicular to the travel, while the remainder are parallel to the travel. The racks are 18 in. deep, with an overall width of 6½ in., and a thickness of ¼ to ¾ in., weighing two to three pounds each. The maximum work area on a single rack would be two ceiling pans with a total of 300 sq in. of plating surface.

"Exhaust ducts run along both sides of the machine, and are located on the floor under duckboards," reports Mr. Weaver. "A 30 in. blower exhausts the fumes through a roof stack.

"By increasing the efficiency of the plating operation, the machine has reduced our plating cost per unit by 20 per cent, and since the plating cost is about 30 per cent of the overall cost of the average unit, it is obvious that a significant reduction in this area permits us to retain a competitive advantage," concluded Mr. Weaver. "The plating equipment is now operating 120 hours per month. It is finishing about 8000 to 10,000 pieces daily, and will meet all our production requirements even during our heavy rush periods. Because of its versatility, the machine can be adapted to our plans for subcontract work which will beef-up our winter production schedules."

Plant of the Hill Plating Co. at Long Beach, California.



The nickel plating tank of the machine, with plating foreman Dick Richardson inspecting the solution.

CINCINNATI: Locale of the AES's Annual Assembly

45th ANNUAL CONVENTION PLANS FORGING FORWARD

OVER A third-of-a-century ago, the American Electroplaters' Society (AES) conducted a successful convention in Cincinnati. In May 1958, over three decades later, the AES will return to Cincinnati for its 45th Annual Convention. For months, an industrious Branch has been laboring to make this AES return to the handsome, thriving metropolis on the banks of the Ohio River, a veritable milepost in the Convention annals of the grown and growing Society. Under the leadership of General Chairman Charles Wise, the pattern is laid, elements are fast falling into place, the prospect of an impressive assembly looms promising as this is written.

The Sheraton-Gibson Hotel, Cincinnati's largest, is the Convention's headquarters' site with at least four other Cincinnati hostelries ready and available for housing accommodations for the AES's growing numbers.

Early in January, every AES member in good standing will have a Hotel Reservation Form mailed to him for prompt action to assure accommodations for himself and family. According to Hotel Chairman Wilson Loveless, this Form must accompany all requests for reservations. The Cincinnati Convention Bureau will not honor requests for reservations without it. So as to be sure that no one is missed, PLATING will also publish the Form in its February issue.

At its meeting in Detroit, December 6, the Editorial Board will continue its work on the Convention's Educational Sessions. The format that it tentatively approved at its September 6 meeting embodies six half-day sessions spanning from Monday afternoon, May 19, through Wednesday, May 21. In addition, a panel session is being visualized, as an innovation, at which practical plating problems can be analyzed with the help of a panel of experts.

As in Montreal last June, the 45th Annual Convention's Registration Fee will be $20 per person (male or female).

Last June, one of the Montreal Convention's most memorable events was its outing in the majestic Laurentian Mountains. There will be change of pace in Cincinnati. Instead of mountains, the AES's conventioneers will enjoy the vaunted hospitality of Cincinnati's Coney Island. An amusement park of wide reputation, it should afford fun and relaxation for young and old, male and female alike.

Led by Mrs. Robert D. Miller, Ladies Chairman, assisted by Mrs. William Young, Co-Chairman, an imaginative Ladies Program is being blue-printed.

Montreal's plant visitation program was outstanding, and the Cincinnati Committee, with a wide variety of industrial plants from which to select, is determined to match or better it.

Considerable emphasis is being placed by the Cincinnati Committee upon producing a noteworthy entertainment program. The Convention's athletic program is also coming in for considerable attention.

"Vas you efer in Zinzinnati?" "Vas you der in de Zpringtime?" Yes or no, plan now to treat yourself and your family to the values offered by the AES's 45th Annual Convention. *YOU'LL be so glad you did.*

Interiors of the Sheraton-Gibson Hotel, Cincinnati, Ohio. (Left) Florentine Dining Room. (Center) Typical guest room. (Right) Grand Ballroom.

CINCINNATI COMMITTEE CREATING COLORFUL CONVENTION

The Host Branch Committee for the AES's 45th Annual Convention to be held in Cincinnati May 18-22, 1958 as it met recently at the headquarters of the Engineering Society of Cincinnati. Left to right: William Young; Robert K. Rarick; Edwin Roof; W. Wilson Loveless; A. R. Waters; Roger Winterman; David L. Kaplan; Charles Wise, Chairman; Ezra A. Blount; Stewart Chipman; William B. Stephenson Jr.; L. J. Howald; Ray A. Barry; Mrs. Robert D. Miller; Mrs. William Young; Arthur J. Gerada.

CHARLES WISE
CHAIRMAN

Secretary of the Buckeye Products Co. and President of Mechanical Finishing Co., he attended Ohio State University and is a life-long resident of Cincinnati. He is active in many community bodies, and is a former Secretary of the Cincinnati Branch.

W. B. STEPHENSON JR.
CO-CHAIRMAN, EDUCATIONAL

Associated with the General Electric Company as a supervisor of chemical and ceramic engineering in the Flight Propulsion Laboratory Department, he was educated at Purdue University and is registered as a professional chemical engineer in Ohio. He is Librarian of the Cincinnati Branch.

RAYMOND A. BARRY
PLANT VISITATION

Graduated from the University of Cincinnati with a Chemical Engineering degree, he was chief chemist, Lamp Division, of Electric Auto-Lite Co. for many years before joining Wagner Brothers Co., recently, as Sales Engineer in the Cincinnati Area.

W. WILSON LOVELESS
HOTEL

A Vice President of the Varland Metal Service Co. of Cincinnati and an alumnus of the University of Cincinnati, he was in the Ordnance Branch of the Army during World War II. He is current President of the Cincinnati Branch.

EDWIN ROOF
REGISTRATION

Also a Vice President of the Varland Metal Service Co., and a graduate in chemical engineering of the University of Cincinnati, he is a Past President of the Cincinnati Branch.

EZRA A. BLOUNT
CO-CHAIRMAN

A graduate of the University of Cincinnati with a degree in Chemical Engineering, he has been associated with the electroplating and finishing industry since 1927. Editor of PRODUCTS FINISHING magazine since 1948, long a member of the AES, he has been an officer of the Indianapolis Branch and is a Past President of the Cincinnati Branch.

STEWART CHIPMAN
ENTERTAINMENT

Owner of the Chipman Supply Co., he is an alumnus of the University of Cincinnati and saw service in the Air Force in World War II. He is a member of the Cincinnati Branch's Board of Managers.

ROBERT K. RARICK
FINANCE

A graduate of Butler University, he is superintendent of special processes at Bendix Aviation Corp., Hamilton, Ohio. He is a Past President of the Branch.

ROGER E. WINTERMAN
PROGRAM

A Navy veteran, a graduate in chemical engineering of the University of Cincinnati, he is a salesman of the Globe Chemical Company of that city.

A. R. WATERS
BANQUET

A graduate of Clemson College with a degree of Chemical Engineer, he is Branch Manager of Harshaw Chemical Co. in Cincinnati area. During World War II, he was a pilot in the Eighth Air Force.

DAVID L. KAPLAN
SECRETARY

Process Engineer of the Electric Auto-Lite Company, Sharonville; another graduate of the University of Cincinnati in Chemical Engineering, he is current Secretary of the Cincinnati Branch.

ROBERT D. MILLER
CHAIRMAN, EDUCATIONAL SESSIONS

A Chemical Engineering graduate from the University of Cincinnati, he is a chemical engineer with Electric Auto-Lite Co., Sharonville, O. He is Past President of Cincinnati Branch, and has served also as Librarian and member of the Board of Managers.

ARTHUR J. GERADA
ATHLETIC

A graduate in chemistry of Eastern Michigan College, he is a Sales Representative of the Udylite Corporation in the Cincinnati Area.

MRS. ROBERT D. MILLER
LADIES

Graduate of the University of Cincinnati, she is the wife of Educational Chairman Miller, mother of three and an active Church worker.

MRS. WILLIAM YOUNG
CO-CHAIRMAN, LADIES

Secretary of the William Young Co., she is active in Church and community affairs. Her affiliations include the Madiera Welcome Wagon; Silvertown Women's Club; others.

L. J. HOWALD
PUBLICITY

An alumnus of Hillsdale College in Michigan, he is a salesman of the Harshaw Chemical Company in Cincinnati. An Air Force veteran of five years during World War II, he is a Past Secretary of the Cincinnati Branch.

L. A. CRITCHFIELD
COORDINATION

A Chemical Engineer with a degree from the University of Cincinnati, he is a registered professional engineer. He is sales representative of the R. O. Hull Co. of Dayton. He is a Past President of the Lancaster Branch.

45th ANNUAL CONVENTION • SHERATON-GIBSON HOTEL, CINCINNATI • MAY 18-22, 1958

AES NEWS

T. R. Boggess

BLUE RIDGE BRANCH TEMPORARILY CHARTERED

Having complied with the eligibility provisions of the AES Constitution and Bylaws, the Blue Ridge Branch, with mainly a Virginia-North Carolina membership, has been granted a temporary charter as a Branch of the Society by the Executive Board effective October 15, 1957.

Effective operation as a temporarily chartered Branch will make the petitioning group eligible for application for permanent charter three months after that date. Acceptance by the Executive Board at that time will make the Blue Ridge Branch a full-fledged AES Branch and bring to 58, the Society's Branches located in the United States, Canada and Australia compared with 54 a year ago.

The Blue Ridge Branch's leadership includes T. R. Boggess, President; Dr. Nelson F. Murphy, 1st Vice President; Carl Witherspoon, Secretary-Treasurer; Paul Callahan, Librarian; S. H. Reynolds, Chaplain. Its Board of Managers is composed of Thomas Howard, Howard Weaver and Howard Welfare.

Mr. Boggess, by the way, is the devoted member of the Society who, for many years, has provided the silver gavel that traditionally has been presented at the Annual Meeting each year to the incoming National President.

CARR NAMED EDUCATIONAL CHAIRMAN

Dr. Dodd S. Carr, research director of the Bart Manufacturing Co. has been elected chairman of the AES's newly formed ten-man Educational Committee succeeding Herberth E. Head, AES First Vice President, who served as acting chairman pending the Committee's election of a permanent chairman.

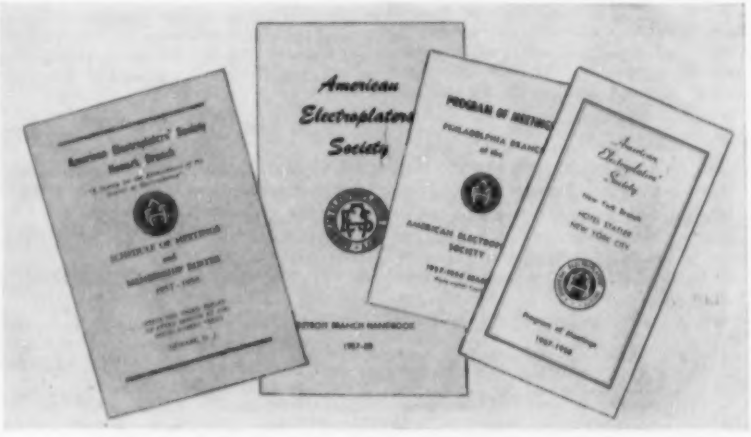
NINE NOMINATED FOR AES's HIGHEST AWARD

Seven Branches of the AES complied with the Society's invitation to nominate candidates for the AES's new Scientific Achievement Award, namely Baltimore-Washington; Columbus; Chicago; Indianapolis; Newark; New York and Philadelphia. Deadline for this year's nominations ended October 15, 1957, by provision of the rules governing the Award adopted by the Supreme Society in Montreal last June.

Intended to recognize outstanding scientific achievement by members of the AES over a full decade's span, nine outstanding men have respectively been nominated by the seven Branches, one of these as the first choice of three of the seven Branches. Four others were Branch first choices; four were second choices.

The dossiers of these nine candidates submitted by the seven Branches have now been channeled by Executive Secretary John P. Nichols to the Scientific Achievement Award Committee recently appointed by the Executive Board. The committee is composed of Dr. Samuel Heiman, Chairman Pro Tempore; Dr. Abner Brenner; Leslie Dively; Dr. Russel E. Harr; Leland M. Morse and Dr. Edward A. Parker.

That committee's selection of the first "William Blum Lecturer" from among the nine candidates will be announced at the Cincinnati Convention in May 1958, and he will deliver his lecture and receive his scroll and $500 honorarium at the AES's "Fifth International Conference on Electrodeposition and Metal Finishing sponsored by the Golden Jubilee Convention of the AES" in Detroit in 1959. At that same Convention, the next year's "William Blum Lecturer" will be announced, and so on.



AMONG BRANCH HANDBOOKS CURRENTLY IN USE

More and more Branches are publishing Branch Handbooks not only listing their Branch Officers and Committee leadership but also their Branch meeting programs for the year. Above, as examples, are this year's handbooks of the Detroit, Newark, New York and Philadelphia Branches received by National Headquarters.

In the case of the Detroit Handbook conceived by Past President Cleveland F. Nixon's "Forward Planning Committee" and created by Manuel Ben's "Handbook Committee", the booklet, in addition, carries a brief biography of the Detroit Branch and the Branch's Bylaws; a list of the Branch's Honorary, Active and Sustaining Members; then, a technical section providing such handy data as conversion factors; temperature conversion chart; specific gravity table; percentage of metal in plating salts; electrochemical equivalents and milligrams per square inch.

Dr. R. E. Harr
President
CHICAGO

A. G. Wiegand
President
ST. JOSEPH VALLEY

E. H. McCoy
President
MILWAUKEE

William Geissman
President
ROCKFORD

B. J. Nordbloom
President
MISSISSIPPI VALLEY

W. W. Johnson
President
TWIN CITY

MID-WEST REGION BEING FORMED

An effective Mid-West Region is in process of formation intended to provide a means of discussion and cooperation on matters of common interest among AES Branches in that particular area. Branches composing the group at this writing are Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and Twin City. Other active, well-established regional AES Branch groups include 1) New England, 2) Tri-State (Ohio, Indiana, Kentucky) and 3) Empire State (Central New York). Plans are progressing, meantime, for the Chicago Branch's popular Annual Educational Session and Banquet that will be held at the Conrad Hilton, Chicago, Saturday, January 25, 1958. General Chairman is Past President Clyde Kelly. Fuller data will be covered in January PLATING.

DETROIT MEETINGS ABOUND DECEMBER 6-7

The Annual Educational Sessions and Banquet of the Detroit Branch at the Statler Hotel, December 6–7 will have important collateral events.

Aside from a full-day's meeting of the Editorial Board on Friday, December 6, the Membership Committee and the "Structure of the Society" Committee will each meet on Saturday, December 7. In addition, the Executive Board will convene in special session that same Saturday.

AES NATIONAL HEADQUARTERS PERSONNEL

ANNE PHALON

A graduate of Hunter College and with background in publishing and advertising, Miss Phalon is the secretary and assistant of PLATING'S editor.

PLATING'S WEST COAST REPRESENTATIVE HONORED

In a poll conducted by "Advertising Agency Register" among all Pacific Coast advertising agency space buyers to determine the Publishers' representatives performing the greatest service to their publishers and advertising agencies on the West Coast, Bob Wettstein & Associates, PLATING's Western Advertising Representative, placed in the "Top Ten" and will be awarded the 1957 Space Buyers Gold Medal for achievement.

The presentation of the Award will be made by James Speer, president of the Western States Advertising Agencies Association at the Hollywood Advertising Club in the near future. To Bob Wettstein and his staff, PLATING extends its hearty congratulations.

Bob Wettstein

IMPROVED 1958 SPEAKERS LIST BEING READIED

Targeted for early 1958 publication for the help of Branch Librarians in scheduling effective Branch Educational Sessions, the AES's 1958 Speakers List is now in preparation.

The mail survey phase already completed included nearly 400 individuals and companies, coast-to-coast, reached by letter for information as to availability for speaking engagements on interesting aspects of electroplating, metal finishing and allied arts. Classified, these data will be included in the 1958 Speakers List, an improved and up-to-date compilation.

Expert both as a user and as a compiler of such lists at Branch level, Philadelphia Branch Secretary I. William Marcovitch, with National Headquarters' active assistance, is the assigned Editor of the 1958 Speakers List. He is Plant Chemist of the U. S. Gauge Division of American Machine & Metals, Inc. of Sellersville, Pennsylvania.

PROGRAM
FIFTH INTERIM MEETING

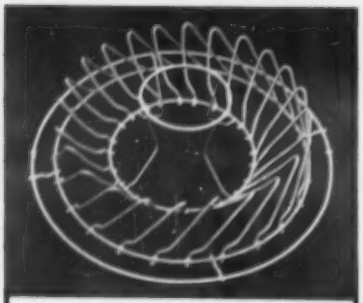
MAROTT HOTEL,
INDIANAPOLIS, INDIANA

FRIDAY, JANUARY 10
(9 A.M. Start)
Meeting, Executive Board

FRIDAY, JANUARY 10
(Evening)
Indianapolis Branch Meeting
Attendance by National Officers and Branch Delegates/Alternates Invited.

SATURDAY, JANUARY 11
(10 A.M. Start)
Interim Meeting
Luncheon
Interim Meeting
Adjournment
Cocktail Party

SUNDAY, JANUARY 12
(9 A.M. Start)
Meeting, Executive Board



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Looking for a plastisol to give you heavy, uniform coatings without preheating your product before dipping?

Then look to Reynosol—America's fastest growing plastisol for cold-dips. Products such as dish drain baskets, gloves, boots, cable, wire—in fact any product of metal, fabric, wood or paper can be successfully cold dipped with Reynosol.

COLOR	UNLIMITED
WEIGHT	SP. GR. — 1.20
FIRE HAZARD	LITTLE OR NONE
% FILM FORMING	95% to 100%
VISCOSITY	10,000 TO 15,000 CPS.
AGING PROPERTIES	GOOD
COLD PROPERTIES	FLEXIBLE AT 65° F
LIGHT RESISTANCE	GOOD
TYPE OF SURFACE	DRY AND GLOSSY
TENSILE STRENGTH	VERY GOOD
SCUFF RESISTANCE	VERY GOOD
ABRASION RESISTANCE	VERY GOOD
ALKALI RESISTANCE	VERY GOOD
ACID RESISTANCE	VERY GOOD
OIL RESISTANCE	VERY GOOD
HARDNESS	AS HIGH AS 90 (SHORE-A)
COST PER .001 INCH THICKNESS	APPX. $.034 SQ. YD.

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INTERSOCIETY NEWS

Purdue Waste Conference Dates Announced

The 13th Purdue Industrial Waste Conference will be held May 5 through 7, 1958 at Purdue University, Lafayette, Ind.

The meetings will be in the Purdue Memorial Union Building where approximately 50 papers are to be presented on subjects dealing with industrial wastes and their treatment.

Everyone interested in waste treatment is invited to attend the conference. Requests for registration blanks should be sent to the university.

The Purdue Union Club, Fowler Hotel, Cedar Crest Hotel and Morris Bryant Hotel, all in Lafayette, are prepared to receive hotel reservations.

Hay Named to NAMF Board

Lawrence J. Hay, Plating Service Co., Chicago, has been named to the board of directors of the National Association of Metal Finishers. Mr. Hay fills the unexpired term of Edward H. Fell, Atlas Plating Works, Cicero, Ill., who resigned several months ago when he entered a new field of endeavor.

The 38-year-old president of one of Chicago's most efficiently run job shops, has served as chairman, vice chairman and director of the Chicago Electro Platers' Institute, NAMF affiliate. He held the positions of vice president and director of the former National Federation of Metal Finishers. Charter member of the NAMF, he is a member of the Chicago Branch, AES.

ASM Presents Annual Awards

Two college professors, one from Japan, the other from Massachusetts, and a top-ranking industrial leader received the highest awards presented annually by the 28,000-member American Society for Metals. In addition, one of Britain's distinguished metal scientists received an Honorary Life Membership in the society.

Awards were made during the society's 39th National Metals Exposition and Congress held in Chicago, November 2 to 8.

The Gold Medal and senior award of the ASM went to Dr. John Chipman, head, metallurgical department, Massachusetts Institute of Technology. To Dr. Tokushicki Mishima, Professor Emeritus, University of Tokyo, Tokyo, Japan, went the Albert Sauveur Achievement Award.

The Gold Medal for the Advancement of Research was presented to Roy C. McKenna, chairman of the board, Vanadium Alloys Steel Company, Latrobe, Pa. An Honorary Life Membership in the ASM was awarded to William Hume-Rothery, lecturer in metallurgical chemistry at Oxford and the University of Sheffield, England. Dr. Hume-Rothery's "research, teachings and many distinguished publications have made an outstanding contribution to our knowledge of the nature of the atom, and particularly its behavior in metals and alloys."

Bissell Appointed by Plastics Engineers

Thomas A. Bissell has been appointed executive secretary of the Society of Plastics Engineers, Inc.

Mr. Bissell brings to his new assignment 21 years' experience as a key staff member of a sister engineering society—the Society of Automotive Engineers. From 1943 until 1957 he was manager of SAE's Meetings Division. From 1936 until 1942 he was technical editor of the SAE Journal.

During World War II he left the SAE temporarily to serve as a civilian employe of the Production Division, Navy Bureau of Aeronautics.

A recent announcement concerning plans for the formation of a Plastics Institute, under the sponsorship of the Society of Plastics Engineers, has resulted in widespread interest among members of the plastics industries.

Plant Maintenance Conference Lists 66 Speakers

Sixty-six speakers, from 22 states, the District of Columbia and Canada, will address the 25 sessions of the Plant Maintenance & Engineering Conference at Chicago in January. The group represents the broadest cross-section of engineering opinion, both from the standpoint of geographical distribution as well as industrial background, ever invited for this meeting.

It will be held during the first three days of the Plant Maintenance & Engineering Show, which is scheduled for the International Amphitheatre, Chicago, January 27–30. Conference sessions will be held both at the Amphitheatre and the Palmer House.

Both the show and conference are returning to Chicago for the first time in three years. The show, the largest in its history, will have 425 exhibiting companies and the exhibit area will be 50 per cent larger than the last time the show was produced in Chicago.

plating rejects ...with WYANDOTTE B. N.!

A message especially for Job Shop Operators:

HERE'S a cleaner that does *all* your job-shop cleaning – on steel, copper, brass, bronze, zinc-base die castings – gives you an efficient, round-the-clock job; cuts rejects, too!

The product? Wyandotte B. N. – a soak cleaner and versatile electrocleaner for direct and reverse cleaning.

Think of it! You need only one cleaner to take care of all job-shop needs!

B. N. gets metal so clean all over that bright plating really sparkles! It also cleans and activates nickel before chrome.

Wyandotte B. N. offers long life and maximum detergency. It is free rinsing; has high soil tolerance and concentrated alkalinity.

Switch to Wyandotte B. N. for *your* job-shop cleaning. Contact your nearest Wyandotte representative, or mail coupon, today! *Wyandotte Chemicals Corporation, Wyandotte, Mich. Also Los Nietos, Calif. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

The Best in Chemical Products for Metal Finishing

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Yes! I would like to know more about Wyandotte B. N. for use in metal-cleaning operations.

☐ **Have representative call** ☐ **Send more complete information**

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

PATENT ABSTRACTS

DR. D. GARDNER FOULKE
Manager, Electrochemical Development
Hanson-Van Winkle-Munning Co
Matawan, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

No. 2,796,370, 6/18/57—Protective Coatings for Aluminum Alloys—C. W. Ostrander, Forest Hill, Md.

A chemical conversion coating for aluminum and alloys thereof is obtained by immersing the article in an acidic water solution of a chromium compound (chronic acid and salts thereof) and at least one cyanide (ferric-or-ferro-cyanide). Another claim also mentions the presence of a fluorine-bearing compound.

See also No. 3,796,370 by Ostrander, et. al. assigned to Allied Research Products, Inc., having 20 claims.

19 claims.

No. 2,796,372, 6/18/57—Corrosion Protecting Composition—A. Chester and B. Jeremais, assignors to Poor and Co., Chicago, Ill.

An aqueous bath yielding corrosion protection to metals consists of 1.5 to 80 g/l of dichromate (as Cr) in a nitric and/or hydrochloric acid (*p*H below 2.0) containing sodium sulfate, a lower aliphatic carboxylic acid and an inorganic reducing agent.

4 claims.

No. 2,796,392, 6/18/57—Deposition of Zirconium—M. Lietzke, assignor to the AEC.

Zirconium is electrodeposited from a bath containing 30–40 mol-per cent of zirconium tetrahalide and 60–70 mol-per cent of an alkyl pyridinium halide.

12 claims.

No. 2,796,394, 6/18/57—Recovering Non-Ferrous Alloys from Ferrous Materials—Ralph Schaeferand G. Kingsbury, assignors to Clevite Corp., Cleveland, Ohio.

Lead-bearing copper base alloys are stripped from steel by a hydroxide-cyanide-tartrate bath at 0.8 v.

5 claims.

No. 2,797,194, 6/18/57—Recovering Precious Metals—R. Anderson and R. Haw, assignors to Western Electric Co., New York, N. Y.

Precious metals attached to a cupric metal base through a nickel metal bonding layer may be stripped by making anodic in a bath containing ammonium chloride and ammonium or sodium bichromate at a *p*H of 5 to 7.5 to dissolve the metal bond.

7 claims.

No. 2,797,476, 7/2/57—Process for Treating Metallic Strip—T. Sendzimer, Middletown, Ohio.

The process consists of moving the strip lengthwise and treating

INDUSTRYS LARGEST PRODUCERS OF LIME BUFFING COMPOUNDS

BRAND New SCHAFFNER C-100

LIME BUFFING COMPOUND
recommended for
MIRROR FINISH ON NICKEL AND COPPER
DRY *and* CLEAN WORKING
Request for SAMPLES on your LETTERHEAD will be honored immediately
WRITE - WIRE OR PHONE - TODAY...

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* TRIPOLI COMPOUNDS * CHROME COLORING ROUGE * GREEN ROUGE * JEWELERS' ROUGE * CROCUS COMPOUND * STAINLESS STEEL COMPOUNDS * ALUMINUM BUFFING COMPOUNDS * ALL-PURPOSE BUFFING COMPOUNDS * WHITE COLORING COMPOUNDS * NICKEL BUFFING (LIME) * EMERY CAKE * PLASTIC BUFFING COMPOUNDS * TALLOW GREASE STICK * PUMICE GREASE STOCK * POLISHING WHEEL CEMENT * STEEL POLISHING COMPOUNDS

COMPOUNDS MADE IN BAR, SPRAY OR PASTE

to bright anneal and to cool under non-oxidizing conditions, followed by temper rolling. The process of applying molten metal, e.g. zinc, then temper rolling is also claimed.

11 claims, figure.

No. 2,798,008, 7/2/57—Coating Method—E. Miller, assignor to Ransbring Electro-Coating Corp., Indianapolis, Ind.

A method for electrostatically coating metals is described.

2 claims.

No. 2,798,009, 7/2/57—Metal Coating Corporation—C. Gault, assignor to Hercules Powder Company, Wilmington, Del.

A coating with good adhesion to metals and an ability to inhibit corrosion consists of 0.5 to 5 parts by weight chromic trioxide, 1 to 20 parts of phosphoric acid and 1 to 200 parts of organo-soluble ethyl cellulose. This is dissolved—3–15 per cent by weight—in an organic solvent for use.

See also No. 2,798,014 assigned to Hercules Powder employing nitrocellulose instead of ethyl cellulose, also No. 2,798,015, No. 2,798,016 and No. 2,798,018 describing the use of polyvinyl butynal resins.

2 claims.

No. 2,798,036, 7/2/57—Electroplating Beryllium—J. Utz, assignor to the United States (AEC).

A method for plating beryllium consists of degreasing in a ketone, rinsing with water prior to evaporation of the ketone, then striking in a cobalt bath of 0.2 to 0.6 M cobalt sulfate and 0.2 to 0.6 M ammonium sulfate.

4 claims.

No. 2,798,037, 7/2/57—Aluminum Oxide Films—P. Robinson, assignor to Sprague Electric Company, North Adams, Mass.

A porous aluminum oxide film is first formed on an aluminum article, then aluminum is deposited in the pores and subsequently transformed into the oxide.

3 claims.

No. 2,798,038, 7/2/57—Electrodepositing Manganese—R. Dean, Hyattsville, Md.

A manganese-containing solution is electrolyzed with a finely divided acid-soluble oxidic manganese compound present to maintain the *p*H at 3 to 6.

No. 2,798,829, 7/9/57—Coating Aluminum—N. Newhard and J. Carroll, assignors to American Chemical Paint Co., Ambler, Pa.

A conversion coating for aluminum is obtained by immersing the articles in a bath of chromic acid (1–10 g/l) and a fluorine bearing compound (fluorine of 0.01 to 2.0 g/l as HF, NaF, etc.) at a *p*H of 1.6 to 1.8.

See also No. 2,798,830 (3 claims) describing the addition also of arsenic and phosphoric acids.

3 claims.

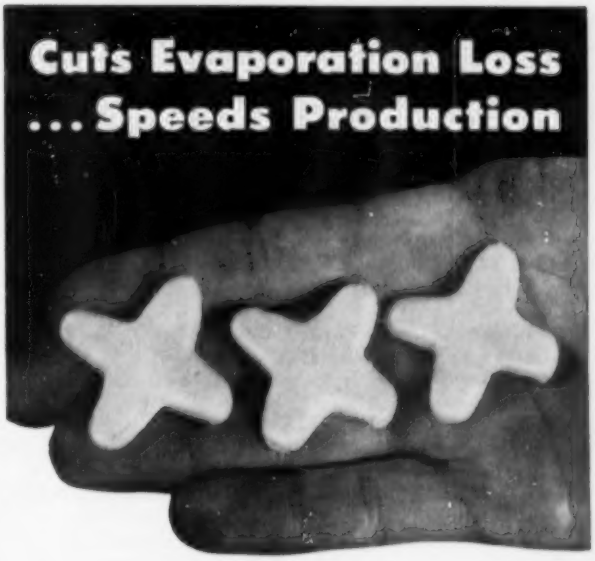
No. 2,798,843, 7/9/57—Plating Titanium—G. Slomin and M. Christensen, assignors to Rohr Aircraft Corp., Chula Vista, California.

To plate titanium, zirconium and alloys rich in these metals immerse the workpiece in an aqueous solution of fluoboric and hydrofluoric acids and, while still wet, immersing in a silver fluoborate solution with the workpiece cathodic at a current density of 25 to 150 asf.

6 claims.

No. 2,798,844, 7/9/57—Titanium Electrolyte—M. Freedman, assignor to Horizons Titanium Corp., Princeton, N. J.

Titanium is obtained by electrodeposition from a fused salt electrolyte consisting of a eutectic composition of compounds of



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potassium, titanium and fluorine melting below 550 C. The proportions are about 22 per cent by weight of TiF_4 and 78 per cent K_2TiF_6.

2 claims.

No. 2,798,846, 7/9/57—Electrolytic Erosion of Work Pieces—G. Comstock, assignor to Norton Co., Worcester, Mass.

A method of electrically eroding conductive workpieces by making a conductive wheel negative and the workpiece positive and while flooding with an electrolyte, e.g., a 5 per cent solution of $KCrO_4$ (22 per cent) and $K_2Cr_2O_7$ (78 per cent).

9 claims, 5 figures.

No. 2,798,849, 7/9/57—Electrolytic Marking Device—Allen Lindsay, Cleveland Heights, Ohio.

An electroetching device with a stencil assembly and an electrolyte reservoir is described.

9 claims, 8 figures.

No. 2,799,601, 7/16/57—Composition for Coating Zinc—H. Hartman, assignor to Allied Research Products, Inc., Baltimore, Md.

The surface of strip after hot galvanizing or electroplated with zinc is subjected to immersion in a filming bath containing 3 to 100 g/l of $Na_2Cr_2O_7.2H_2O$; 1 to 35 g/l of H_3BO_3; 0.1 to 20 g/l of NaCl and 1 to 10 ml of HNO_3 (42Bé). The *p*H is given as 0.2 to 4.0.

No. 2,799,633, 7/16/57—Bright Gold Plating—E. Rinker, assignor to Sel-Rex Precious Metals, Inc., Belleville, N. J.

The electrolyte, providing bright gold deposits is given as:

KCN (free)	45–200	g/l
K Au $(CN)_2$	6–48	g/l
K Ag $(CN)_2$	08–0.4	g/l

The ratio of silver cyanide to gold cyanide is given as 1.5:100. Claim 7 describes the addition of cobalt and nickel cyanides and alkali metal thiocyanates.

7 claims.

No. 2,799,634, 7/16/57—Acid Copper Plating—R. Woehrle and J. Condon, assignors to Westinghouse Electric Corp., East Pittsburgh, Pa.

Bright, smooth copper electrodeposits from acid copper baths are obtained when 0.01 to 1.0 oz/gal of dextrose and 0.005 to 0.015 oz/gal of 1-acetyl-2-thiohydantoin are added.

8 claims.

No. 2,799,635, 7/16/57—Zinc Electroplating—A. Chester and R. Main, assignors to Poor and Company and Acme Steel Co., respectively, Chicago, Illinois.

A fine-grained ductile zinc can be plated from an acid zinc sulfate bath to which is added thiourea (0.28 to 4.48 g/l) and peptone (0.075 to 0.5 cc/l, e.g., Wilson and Co., Peptone No. 421).

7 claims.

No. 2,799, 636, 7/16/57—Processing Separable Fastener Stringers—R. MacLachan, assignor to Coats and Clark, Inc., Wilmington, Del.

To deburr separable fastener stringers immerse fabric and all in a cyanide plating bath of a metal corresponding to composition of the stringers and anodically treat.

2 claims.

No. 2,800,403, 7/23/57—Molded Abrasive—Wm. Boeler, et.al., assignors to American Viscose Corp., Philadelphia, Pa.

A molded abrasive product can be made by wetting abrasive

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COMPOUNDS MADE IN BAR, SPRAY OR PASTE

grits with a liquid phenol—aldehyde condensate, thereafter mixing with the wetted grits a chopped rag filler impregnated with an amino-triazine-aldehyde precondensate and hot pressing the mixture.

12 claims.

No. 2,800,416, 7/23/57—Coating Lead Strip—E. Walters, assignor to Libbey-Owens-Ford Glass Co., Toledo, Ohio.

The method describes a method of solder-coating lead strip on a continuous basis.

14 claims, figure.

No. 2,800,419, 7/23/57—Hard Surfacing Metals—H. Kough, assignor to Coast Metals, Inc., Little Ferry, New Jersey.

A fuel gas torch method is claimed for hard surfacing using powdered metal particles.

13 claims, figure.

No. 2,800,420, 7/23/57—Cleaning Metal Strip—R. Dunlevy, et.al., assignors to Kolene Corp., Detroit, Michigan.

An apparatus is described for continuously cleaning metal strip in a molten salt bath as per US P. No. 2,458,661, in which care is taken to prevent the deposit of particles on rollers driving and guiding the strip through said molten bath, rinses, etc.

2 claims, 2 figures.

No. 2,800,421, 7/23/57—Coating Stainless Steel—E. Goodspeed, et. al., assignors to Parker Rust Proof Co., Detroit, Michigan.

The process consists of contacting the stainless steel with an aqueous bath containing oxalic acid, an activating ion (halide, thiocyanate) and an organic compound containing a nitro group (e.g. about 0.1 per cent meta-nitrobenzene sodium sulfonate) at about 190 F. The halide class of compounds contains chlorides, bromides, fluorides, silicofluorides and borofluorides. Other nitro compounds mentioned are nitroguanidine and picric acid.

12 claims.

No. 2,800,422, 7/23/57—Rust Proofing Steel—Achille Piccinelli, Turin, Italy.

There is formed on the iron article a phosphate coating (Fe, Zn, Mn) which is dissolved off. A chromate coating is then formed thereon with a solution containing chromate or dichromate ions.

1 claim.

No. 2,800,436, 7/23/57—Chromium Plating—J. Stareck and E. Seyb, assignors to Metal and Thermit Corp., New York, N. Y.

A method of chromium plating to reduce loss of fatigue strength of high strength steels consists of plating from a sulfate catalyzed chromic acid bath containing calcium to control the CrO_3:$SO_4^{=}$ ratio from 75:1 to 150:1 and a basic metal (Na, K, Ca and NH_4^+) to neutralize 10.75 per cent of the bath, and finally heating at 350–550 F for 2 hours.

See also No. 2,800,437, 14 claims, No. 2,800,443, 11 claims, and No. 2,800,438, 14 claims, granted same inventors.

17 claims.

No. 2,800,439, 7/23/57—Bright Plating—J. Fischer, et.al., assignors to Deutsche, Gold-and-Silber-Scheideanstalt, Frankfort, Germany.

Bright gold, Silver, and gold-silver alloys can be deposited from cyanide baths to which is added a condensation product of carbon disulfide with acrolein (and alpha substituted acroleins). It is claimed that 0.2 to 1.5 g/l of the condensation product is needed and Turkey Red oil or polyglycol esters are helpful.

12 claims.

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Semi-Annual Meeting
Committee B-8
American Society of Testing Materials

October 17-18, 1957
Hotel Benjamin Franklin, Philadelphia, Pa.

Summary by
Dr. Edward B. Saubestre

Chemistry Laboratory
Sylvania Electric Products Inc.
Flushing, N. Y.

Member ASTM Committee B-8, AES, Electrochemical Society, ACS, AICHE

Sub-I (Specifications): Chairman—Fielding Ogburn

Three standards (B 166, B 200, B 201) are due for re-confirmation at the next meeting. It was noted that proposed Specifications often receive negative votes for purely editorial reasons. To avoid this situation in the future, it was decided to establish an Editorial Review Section. Dr. F. A. Lowenheim was appointed chairman of the new section.

Section B (Definitions): Chairman—W. H. Safranek

Agreement is near on most items drawn up by Drs. Blum and Lowenheim and ASM. It is hoped that a complete list will be submitted to the members by the time of the next meeting.

Section C (Electroless Nickel): Chairman—W. Moline

The first draft of the monograph is complete. The eight chapters are: 1) Historical introduction, 2) Chemistry, 3) Properties of the Deposit, 4) Processing Procedures, 5) Advantages and Limitations, 6) Applications, 7) Methods of Testing, 8) Patents, and a Bibliography.

Section D (Industrial and Heavy Nickel Coatings): Chairman—D. S. Carr

M. Barrow's report last year in Section A recommended that new ASTM specifications be written to cover heavy (2 mil) Ni and Cr coatings. The present Section was constituted after the last meeting. Thus far, it has collated available material, including that of Barrow's former Section and applicable Federal Specifications. It is expected that new specifications will be available for consideration at the February meeting. Electroless nickel and Ni-phos coatings will not be considered.

Section E (Labelling): Chairman—E. B. Saubestre

The task group set up to investigate the question of labelling plated coatings has made the following recommendations: 1) Policing by ASTM, or even by FTC is unlikely. However, there is precedent in ASTM for policing by the consumer in such cases. 2) It was agreed that automotive and aircraft manufacturers who depend on corporate or military specifications would not be interested. Rather, it was felt that manufacturers of hardware and tubular furniture, mail order houses, five-and-dime chains, and the like, would be so interested. 3) It was agreed that if plated coatings are to be marked, ASTM designations must become more meaningful. The task group was reconstituted as a Section to further this work.

Task Group (Education)

It was suggested that ASTM investigate the feasibility of educating the public on the maintenance of plated coatings such as on automobile parts. A task group will be set up to explore this possibility.

Sub-II (Performance): Chairman—W. L. Pinner

Section A (Corrosion)—D. M. Bigge

Inspection of the Program 4 Cu-Ni-Cr panels continues. In testing panels with 5, 10, 30 and 60 millionths of Cr, it appears that corrosion protection increases with increasing Cr thickness, but luster is lost beyond 10 millionths of Cr. Results with Watts Ni plated panels appear to be more reproducible than with bright Ni plated panels.

Section C (Zn,Cd): Chairman—R. E. Harr

Chromated Zn and Cd plated panels went on test at Kure Beach, Rock Island and New York in August.

Section F (Aluminum): Chairman—J. W. Kerstetter

A proposed testing program has been submitted and was approved with some changes. It is proposed that photographic standards be set up to evaluate corrosion results on Cu-Ni-Cr plated Al panels. Some steel panels will be included for comparison purposes.

Since some disagreements have arisen concerning evaluation of ASTM corrosion test specimens, it has been recommended that suitable standard panels be developed to assist in rating test panels. C. H. Sample was appointed chairman of a task group to look into this problem.

Sub-III (Conformance): Chairman—R. F. Ledford

Section A (Thickness): Chairman—A. H. DuRose

Data on thickness measurements made by various cooperating laboratories are being analysed by the Bureau of Standards. For zinc plated steel panels, considerable bias was found between cooperating laboratories' results for a given thickness test. For 0.3 mil coatings, results from 0.2-0.4 mils were obtained using Magne-gage, stripping methods, and drop tests. A sub-section headed by R. E. Harr is investigating the Magne-gage, Dermatron, Boonton and Kocour instruments. Consensus at present favors stripping methods, such as use of the Kocour instrument or its equivalent.

Section C (Hardness): Chairman—M. M. Beckwith

Fourteen companies have evaluated various hardness testing methods, and little reproducibility has been found. It was felt that such hardness measurements are of little interest for decorative or protective coatings, but would be of considerable interest for heavy industrial coatings. The sub-section on ductility measurements (A. D. Squitero reporting) was discontinued, due to lack of suitable tests to examine, and to lack of a definition of ductility that could be generally agreed upon.

Section F (Stress): Chairman—L. Morse

An industry round-robin covering use of flat strip, spiral contractometers, and Stresometer methods is now underway.

Sub-IV (Plating Practice): Acting Chairman—E. B. Saubestre, for M. Frager, Chairman

Section K (Cleaning): Chairman—S. Spring

The revised Recommended Practice on Preparation and Cleaning of Metals prior to Electroplating will be submitted to Sub-IV for letter balloting within the month.

Section N (Double Nickel Coatings): Chairman—B. Knapp

The task group found sufficient interest in double nickel coatings to warrant writing an ASTM Specification. Section N was set up to accomplish this. Three systems will be considered: 1) Nickel-buff-nickel, 2) nickel-abrasive grind-nickel, 3) nickel-rinse-nickel (in same or another NI solution).

Section W (Industrial Water): Chairman—H. Kafarski

Work of the group has begun by calculating rate of build-up of water-borne impurities in plating solutions, using Kushner's and Pinkerton's equations. The Section is also considering other approaches, such as use of standard water samples by various laboratories, or use of standard plating solutions containing known contaminants for similar round-robin testing.

ASTM B-281-53T (Copper) was continued as a Tentative Standard. B 319-57T (Lead) and B 320-57T (Cast Iron) were added as new Standards in the 1957 ASTM Book of Standards.

Sub-V (Organic Coatings): Chairman—G. E. Best

Section B (Chromated Zn): Chairman A. Mendizza

It is proposed to evaluate finishes based on the hexavalent Cr content. The salt-spray or acetic salt-spray test will be used for the evaluation.

Section D (Chromated Cd): Chairman—L. Gilbert

The panels have been placed on exposure and a preliminary examination has been made.

Section E (Phosphate Coatings): Chairman—S. Spring

Dr. Spring was appointed chairman of the newly re-activated Section, which will initiate work shortly.

Section F (Organic Finishes): Chairman—F. L. Scott

A report on factors which influence adhesion of organic finishes on Cr coatings will be published in the 1958 ASTM Reports. It was voted not to permit publication in other journals prior to this time.

It was voted to set up a new section shortly to investigate chromate coatings on Al and Mg, following resolution of jurisdictional problems with B-7.

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INDUSTRY NEWS

Efco Udylite Technical Conference—The second three-day technical conference of Efco-Udylite overseas distributors was held in Weybridge, England, from October 2 to 4. Visitors included L. K. Lindahl, chairman of the board of the Udylite Corporation, Dr. Henry Brown, Udylite research director and representatives from Austria, Belgium, Denmark, France, Germany, Holland, Italy, Norway, South Africa, Spain, Sweden and Switzerland.

The conference was opened by D. F. Campbell, chairman of Electro-Chemical Engineering Co. Ltd. A full program included a number of technical papers and a film of the Udylite automatic bumper bar plating plants, the largest in the world, built for the Ford Motor Co. at a cost of 12 million dollars. Visits were arranged to the company's facilities at Sheerwater and to Norman Hay Ltd. and Hoover Ltd., High Wycombe, to study Efco-Udylite automatic plating installations.

For the Electro-Chemical Engineering Co. who represent the Udylite Corp. in Europe and the British Commonwealth, it was an opportunity to bring their overseas distributors together and to discuss common problems with their American associates. It also demonstrated the way representatives from so many overseas countries can work together and enjoy each other's company socially.

Solvay Plant Completed—Completion of expansion program doubling the capacity of its Brunswick, Ga., mercury cell chlorine-caustic soda plant, has been announced by the Solvay Process Division, Allied Chemical & Dye Corp.

Brunswick, Ga., is the newest link in the Solvay chain of plants serving major industrial areas.

American Buff Marks Milestone—Employes of the American Buff Co. recently toasted their company's growth at a special 22nd anniversary celebration. In a short talk, the chairman of the board, Ben P. Sax traced the company's history from a small shop. Following his annual custom, Mr. Sax presented each of the company's employes with a canvas money bag containing 22 silver dollars—one for each year of American Buff's existence.

(Top left) Representatives at the Efco-Udylite Conference, Oatlands Park Hotel, Weybridge, England, Oct. 2–4. (Top right) Dr. Henry Brown, The Udylite Corp., Detroit, Mich.; H. L. Greenwood, The Electro-Chemical Engineering Co. Ltd., Woking, England; K. Sommer, Friedr. Blasberg, GmbH, Germany. (Lower left) J. Prier, Societe Continentale Parker, France; J. Corbiere, Ets. R. Corbiere & Cie, Belgium; L. Ades, Societe Continentale Parker. (Lower right) R. Corbiere, Ets. R. Corbiere & Cie; H. J. Bache, Electro-Chemical Eng. Co. Ltd.; Dr. L. K. Lindahl, The Udylite Corp.; Mr. Dete, Societe Continentale Parker; Dr. A. Hock, Friedr. Blasberg; Harold Silman, Electro-Chemical Eng. Co. Ltd.

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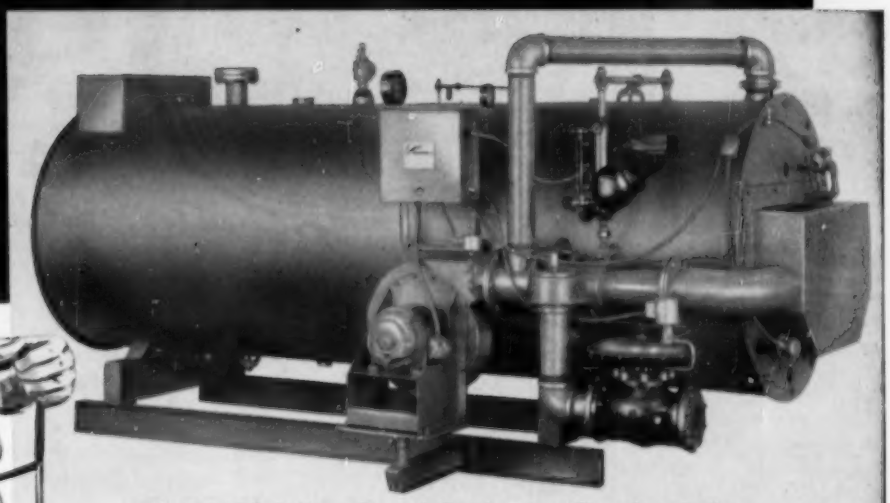

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National Aluminate Completes Additional Facilities—National Aluminate Corp. recently moved through a third phase in its two-year expansion program with the completion of a five-story addition to its administrative and laboratory facilities.

Total office, laboratory, manufacturing and warehouse area for the chemical firm's main operation now exceeds 365,000 sq ft, on property covering 16 acres—and establishes Nalco as one of the largest companies in Chicago's Clearing Industrial District.

The Nalco organization also includes seven other manufacturing sites in the U. S., Canada and Europe.

Kelite Holds Sales Conference—The fall sales management conference of Kelite Corp., Los Angeles, Chicago, Dallas, Berkeley Heights, New Jersey, and Toronto, manufacturers of industrial chemicals and steam cleaning equipment, was held Sept. 10 and 11 at Los Angeles, with all sales management personnel from the United States and Canada in attendance.

Guests at the conference were Dr. A. Kenneth Graham of Graham, Savage and Associates, and Victor Gibson, president of Gibson-Kelite Pty. Ltd., Melbourne, Australia. Dr. Graham spoke on the significance of soak cleaning prior to plating. Mr. Gibson described Kelite's Australian operation.

A special report was given by Dr. Sam Spring, Kelite's laboratory director, on the latest government approval of the firm's products. He also discussed Kelite's latest developments in phosphate coatings including a new room temperature spray-type zinc phosphate coating about to be marketed.

Haveg Acquires Lithgow—Haveg Industries has acquired the Lithgow Chemical Co. of California, manufacturers and applicators of chemical corrosion resistant plastic coatings, cements, impregnations and laminated linings.

By this acquisition, Haveg has broadened their line of coatings as well as providing new production facilities on the Pacific Coast. In addition to plants in Wilmington, Del.; Norwalk, Calif.; and West Warren, Mass. Haveg is reported to be considering additional facilities for the manufacture and distribution of coatings and linings.

New Anodizing Plant in Production—The Aluminum Anodizing Co. is occupying its new plant at 3630 N.W. 76th Street, Miami, Fla.

Fred M. Carlson, president of the company, points out that the plant is one of

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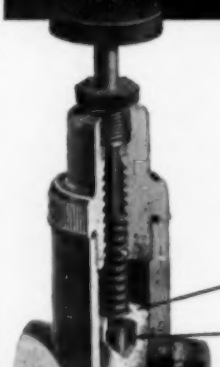

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- Handles wide range of corrosives and slurries

- Back-seating feature of cap: when valve completely open, relieves pressure on packing.
- Free-to-swivel plug: provides even wear of cap, perfect closure.
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- All-plastic design — PVC or styrene-copolymer. Replaceable caps available in Neoprene, Buna-N, and Hypalon (Kel-F elastomer on special order).
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- Adaptable to all existing plastic pipe and fittings; especially suited to Vanton P, S, and N lines of plastic pipe and fittings.
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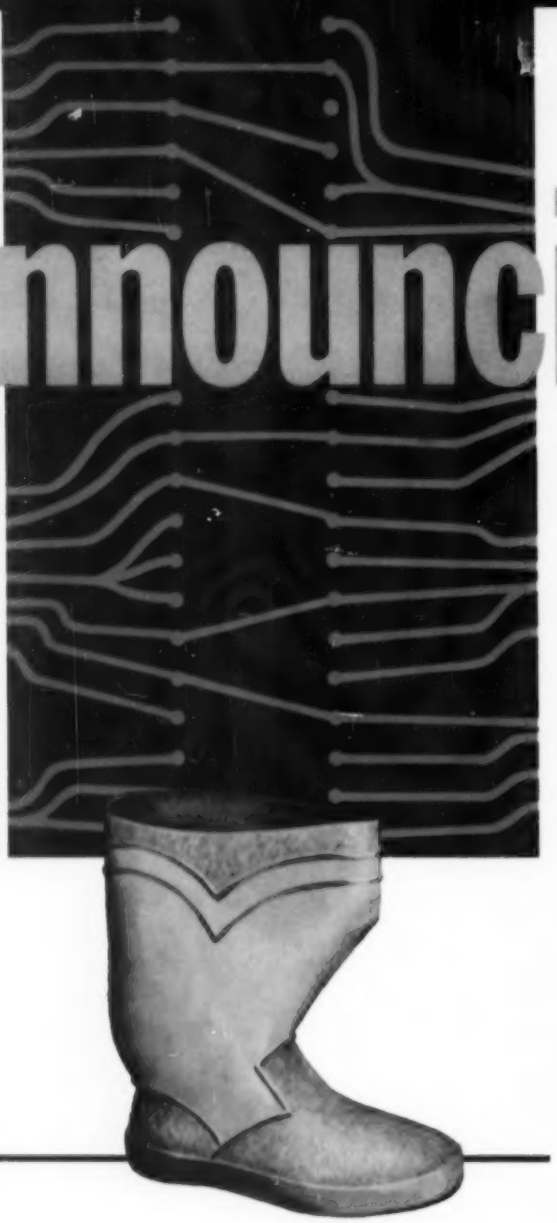

an acid-copper process for producing smooth, ductile, tree-free, heavy deposits at high speed

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VISITOR FROM SOUTH AMERICA —Edwin Bronner Patrias, right, of Industrias de Articulos Metalicos, Ltd., Bogota, Colombia, visits John Kosmos, Kosmos Electro-Finishing Research, Inc., Hackensack, N. J., on recent business trip to the United States. The Colombian metal finisher is shown here seeking information on protective finishes for zinc and cadmium plated parts which will withstand the hot, humid conditions in South America. Mr. Bonner Patrias stressed the need for technical services in Latin America.

the most advanced mass production job shops in the anodizing field.

The processing equipment of the plant is arranged in the manner of an assembly line to take advantage of automation. The tanks are spanned by a crane system and the material is handled through the process by an electric hoist. The necessity for flexibility in the speed of handling the material through the various solutions led to the building of a specially designed variable speed hoist. Rectifiers provide 6000 amp of direct current.

Aluminum jalousies, windows and extrusions comprise the bulk of the material anodized, with the remainder made up of tub and shower enclosures, ornamental metal work and railings. Miami's huge aircraft industry and the expanding guided missile program in that area is providing an increasing volume of work.

Line-O-Coat in New Plant—Line-O-Coat Industrial Co., designers and manufacturers of industrial equipment, has completed occupancy of new engineering and manufacturing facilities at 1230 So. Santa Fe, Compton, Calif.

The 10,000 sq ft plant will enable the company to double production capacity. Line-O-Coat manufactures corrosion-resistant, fiberglass reinforced plastic air-handling industrial equipment, including plating tanks, hoods, ducting, washers, and complete plating systems.

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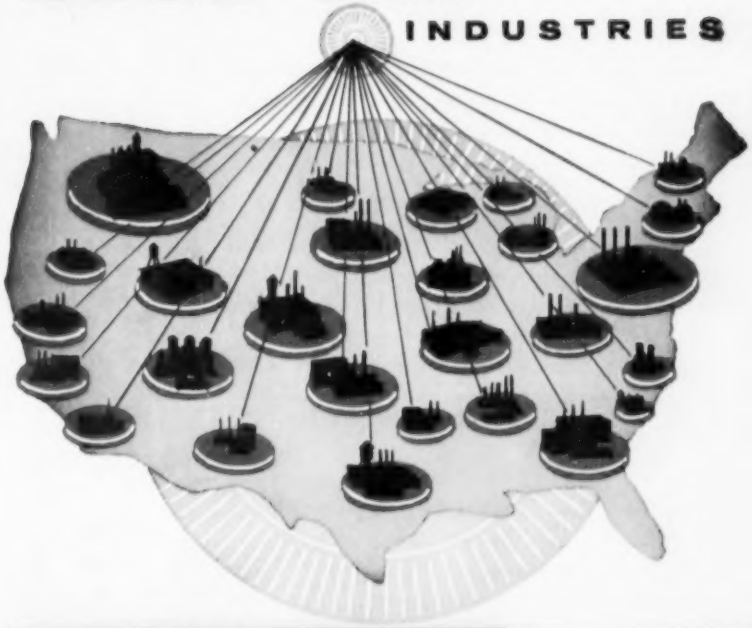

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Traditions in Brass Plating

●

With this as the part of the year with the most holidays such as Halloween, Thanksgiving and Christmas, superstition and tradition become important to those of us with children.

●

This same tradition and superstition seems to govern many platers who do brass plating. With all the scientific advances most platers are still using the brass plating techniques of 30 or more years ago. Such ideas as free cyanide, 80-20 anodes as applied to brass plating are definitely in the category of tradition.

●

For ten years True Brite has been publishing modern techniques in brass plating. These ideas have been proven sound and practical over and over but still are resisted and improperly applied by many platers. Analysis methods are available that are accurate and simple but many chemists cling to old methods that have defects of which they are unaware. Others feeling they are modern use a plating cell and feel it is a complete answer. The old ideas of "free" cyanide must be discarded to secure uniform results on any but a hit or miss basis. True Brite has developed the balanced formulations which enable correction by analysis which will work. To maintain this balance you can analyze the solution every shift and make additions accordingly or you can add our balanced Brass Maintenance Solution or Compound that takes care of normal maintenance so that the analysis and correction can be done at your convenience at infrequent intervals.

●

If we wanted to publish testimonials we could give you glowing accounts of the performance of our materials. Instead we'll tell you you're missing something if you don't try our materials. But you have to go along the whole way and start out right. It seems there aren't any short cuts to success. All we can do is give you the rules and the football. You have to make the touchdown yourself.

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INDUSTRY NEWS BRIEFS

● The new plating department and waste treatment facilities currently under construction at the Stamford, Conn. plant of Pitney-Bowes, Inc. have been designed by Graham, Savage and Associates, Inc., Jenkintown, Pa.

In addition to relocating existing plating activities, complete waste treatment facilities are being provided for treating waste from cyanide, heat-treating, various plating operations, including chromium plating, cyanide cadmium and copper, nickel and others; and a spray-painting department. An unusual feature is that the complete waste treatment installation is housed indoors beneath the plating department. Due to this restricted area, the size of treatment equipment is limited, and every means had to be employed to reduce water consumption without sacrifice in plating quality.

● United States industry's solution to stepped-up overseas sales may not be increased exports, but the licensing of companies in the countries to be served to produce the United States firms' products, according to L. K. Lindahl, chairman of the board of directors of The Udylite Corp.

Just back from a London meeting of his company's distributors for Europe and Great Britain, Mr. Lindahl cited Udylite's experience as indicative of progress to be made by licensing foreign concerns.

Electro-Chemical Engineering Co. Ltd., known throughout the territory as "Efco-Udylite," is the overseas distributing organization. Some equipment produced by the parent company in the United States is sold abroad but most foreign sales involve machinery manufactured to home office specifications in other countries. The Udylite machines sold in Europe, Africa, India and Australia are manufactured in England, West Germany and France.

● Consumption and imports of nickel in July were 24 and 15 per cent, respectively, less than in June. The reduced usage of nickel in July resulted largely from suspension of operations at some plants for vacations.

Consumption of nickel in the United States by 204 companies, which accounted for 94.7 per cent of the nickel in all forms used in 1956, was 16,920,112 lb in July, which indicated that total consumption was 17,867,000 lb, compared with 23,657,000 lb in June.

● World mine production of zinc was about 3,330,000 short tons in 1956 compared with 3,180,000 tons in 1955. World smelter production of slab zinc increased from 2,970,000 to 3,110,000 tons. The United States continued to be the leading zinc-producing country (mine output), followed in order by Canada, USSR, Australia, Mexico and Peru. Total consumption of zinc in foreign countries, particularly in the United Kingdom, decreased, and the supply was plentiful except for short periods in some countries when shipments were being rerouted owing to the closing of the Suez canal in October.

● Shipments of copper sulfate in September decreased 32 per cent from August, and, except for February, were at the lowest rate of the year, according to the Bureau of Mines, United States Department of the Interior. Production dropped 16 per cent, but was 500 tons in excess of shipments; and stocks rose 17 per cent.

● Military scientists are seeking a lightweight substitute for steel and would welcome the help of civilian scientists, according to a new publication of the National Inventors Council, U. S. Department of Commerce.

The new material should possess the same properties as steel and cost no more, reports NIC, while weighing at least 25 per cent less. The substance should have equal or superior corrosion-oxidation characteristics.

● An information center has been established by the Air Force at Battelle Memorial Institute, Columbus, Ohio, to gather and disseminate data concerning the effects of nuclear radiation on materials and systems which may be required in aircraft of the future. It will be known as the Radiation Effects Information Center. Nuclear-propelled aircraft will need radiation-resistant materials, components, and equipment.

UNICHROME

News about

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Chromium plating goes "specialized"

A BARREL OF SAVINGS IN SMALL PARTS PLATING

The *continuous* Unichrome plating barrel designed by Metal & Thermit is a real production tool. It equals 4 batch type barrels in output; plates up to 200 pounds of parts per hour. It offers "automation" to plants that must chromium plate hundreds of thousands of small parts per day.

• • • • • • • •

Immersion heater uses tough tantalum

An advanced type of electric immersion heater developed by M&T uses an acidproof tantalum tube to protect the heating element, promote good heat transfer. This tantalum sheath eliminates cracking such as may be encountered with brittle quartz heaters. Thermostatically controlled, the unit is rated at 5 KW, develops 17,000 Btu/hr—enough heat to raise 100 gallons of water 20°F per hour.

Send for data on above equipment.

Unichrome is a trademark of Metal & Thermit Corp.

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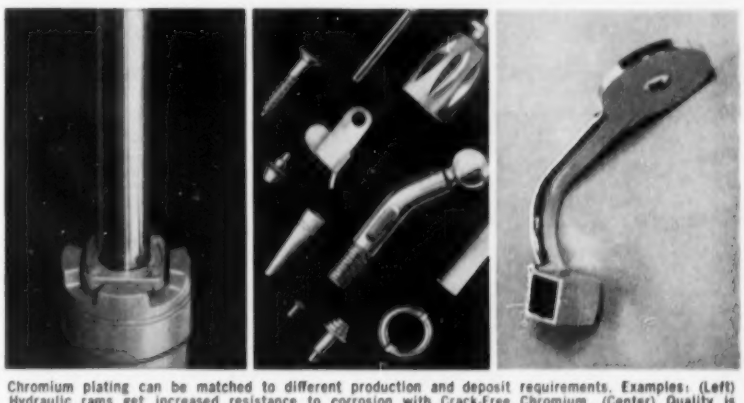
Deposits and bath characteristics matched to different needs



Chromium plating can be matched to different production and deposit requirements. Examples: (Left) Hydraulic rams get increased resistance to corrosion with Crack-Free Chromium. (Center) Quality is assured on barrel plated small parts by a special SRHS Bath. (Right) Both operations and results are improved in decorative plating with SRHS Chromium.

Meeting today's demand for more automation and specialized production "tools," M&T offers a *line* of processes to satisfy any chromium plating need. "Chromium is chromium" cannot be considered an accurate statement any longer. Chromium can differ in the *way* it is deposited and in *nature* of the deposit.

THE DIFFERENCES

Unichrome Crack-Free Chromium is a new type of *ductile* deposit in that it is free from the cracks riddling ordinary chromium. It affords more corrosion protection, reduces nickel need. It also withstands thermal shock better, and improves wear resistance. Thus, it is being used where electrodeposits formerly proved inadequate. Crack-Free Chromium, like all other Metal & Thermit chromium solutions, is self-regulated or "automated."

For other requirements, Unichrome SRHS® Chromium Baths have the advantages over ordinary chromium of wider bright plate range, self regulation for optimum plating balance, up to 80% more speed. While the SRHS deposit is similar to ordinary chromium structurally, the *way* it plates makes a substantial difference in the output. It permits plating more work per load, cuts rejects due to missing and burning.

VARIOUS SOLUTIONS

The SRHS line offers a number of different solutions with varied operating characteristics. This selection makes possible exact cost-reducing and quality-improving matches between plating solution and production requirements. Developed especially for barrel chromium plating, one bath in the group assures lower cost high quality finishes on volumes of small parts.

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"Duke" Dent

MEET MR. PRESIDENT

Marmaduke H. Dent, supervisor of the electroplating department of Pan American Airways, Miami, Fla., is the 1957–1958 president of the Miami Branch of the American Electroplaters' Society.

On first joining Pan American Airways in 1942, "Duke" served as a chemist, where his activities were concentrated on electroplating of various aircraft and engine parts. On a trip to Pratt & Whitney Aircraft at Hartford, Conn. in 1943, he met the Society's former National President, Arthur Logozzo. Subsequently, Pan American's plating operations progressed from a staff of two or three chemists to a group of twenty-five platers and technicians performing the overhaul and repair electroplating necessary for the maintenance of engines and components.

"Duke" was born in Roanoke, Va., in 1912. Moving to West Virginia, he attended grade and high school there and went on to Glenville State Teachers College at Glenville, W. Va. During his high school and college days he worked part time in the retail drug business. After relocating in Miami, he worked as a druggist from 1934 until 1942.

"Duke" has taken many refresher courses in chemistry and mathematics as well as courses in aircraft materials and processes at the University of Miami.

A LAST CALL FOR ORDERS FOR LAST YEAR'S "TECHNICAL PROCEEDINGS"

As announced on a previous page of this PLATING issue, the 1957 Edition of the book of the American Electroplaters' Society (AES) titled TECHNICAL PROCEEDINGS has made its appearance and copies of it are enroute to AES members globally. Extra copies remaining after member distribution are being offered to non-members for purchase at prices and terms stated on that page.

Less than a hundred copies of the 1956 Edition of that book are also available for order by non-members on a *first-come first served basis so long as that limited supply lasts.* Domestic price is $12.50 per copy. On orders from outside of the United States' continental limits, the cost is $13 per copy. Postage is included in purchase price. *All orders must be accompanied by full payment to obviate unnecessary bookkeeping expense.*

Address orders to the

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L—1201. Hard Bright Gold—Detailed information on hard bright gold is presented in a new brochure by Technic Inc. Specifically, data are given on Technic HG gold, which was developed to meet long-standing industrial requirements. HG gold has a wide operating range and is said to contain practically no free cyanide.

The electrodeposit produced by Technic HG gold is described as bright and smooth-grained, with less porosity. Diamond point hardness of the deposit is between 130 and 150, with a karat fineness exceeding 23.

L—1202. Printed Circuit Resist—A special coating for streamlining production of printed circuit boards has been developed by LePage's, Inc., Gloucester, Mass.

The new coating, known as LePage's Printed Circuit Resist, is a photo sensitive coating employed to cover the copper surface of a circuit board before the image is transferred. The solution is ready for immediate use without mixing or other preparation.

Tests have shown the new coating keeps well in solution form and will remain stable for six months. LePage's has prepared a pamphlet on printed circuit resist.

L—1203. Liquid Buffing Compound—An automatically applied liquid buffing compound which saves buffing time and increases buff life up to 200 per cent is described and illustrated in a 4-page, 2-color bulletin now offered by Hanson-Van Winkle-Munning Co.

Bulletin LC-100 explains easy installation of this new Liquimatic system in terms of its three simple elements: the pump, the master control, and spray guns. Economy and efficiency features of the exclusive metered master control are described in detail.

L—1204. Etch Salts—The use of dry fluoride bearing salts to replace liquid hydrofluoric acid in metal finishing treatments is fully described in Technical Data Sheet No. 50, a two-page usage and instruction sheet prepared by MacDermid Incorporated. Called Metex Etch Salts, the dry salts are shipped in polyethylene lined fiber drums which require no deposit and are non-returnable. Shelf life of the unopened drum is indefinite. Metex in solution is reported to activate metal surfaces prior to plating, remove silicate films, promote better adhesion and help produce brighter deposits.

L—1205. Industrial Gold Plating—An eight-page paper on industrial gold plating, by E. C. Rinker, technical director, Precious Metals Division, Sel-Rex Corp., again is available. A prize winning technical paper originally presented before the 40th Annual Convention of the American Electroplaters' Society, this definitive article has been reprinted a dozen times due to the ever present demand.

The paper treats, in detail, such topics as bath composition, equipment and operating conditions, and comparative metallurgical characteristics of 24K Gold Plate on various base metals. Profusely illustrated with photomicrographs, the paper also includes a series of graphs and tables indicating rates of deposition at various current densities and under different operating conditions.

L—1206. Brush Plating Booklet—"Practical Brush Plating With the Dalic Process" is the title of a new booklet made available by Marlane Development Co. It is based on a paper by Marv Rubinstein.

The booklet explains the process, analyzes the metallurgical properties of the deposits, and devotes more than eight pages to descriptions of typical time-saving engineering applications. Among these are touching up; resizing of mismachined components; precision fitting of bearings; electroforming corrections, cold welding, soldering and brazing; selective stopping-off before heat-treating; plating on difficult-to-plate metals; depositing extremely pure metals; and automatic wire and strip plating.

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By
WILLIAM TUCKER
Eastman Kodak
Rochester, N.Y.

Most of the articles listed here may be obtained by writing to the publications in which the articles were published. Addresses are given at the end of the references for the reader's convenience.

Photostat or microfilm copies of articles in available magazines may be obtained from: Library of Congress, Washington, D. C.; New York Public Library, New York; Engineering Societies' Library, New York, at prevailing rates. In other cases, consult Wilson's Union List of Serials at your nearest public library for other sources of these articles.

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Corrosion Technology
Leonard Hill Technical Group
Stratford House
9 Eden St.
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Electroplating and Metal Finishing
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Munich, Germany

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Zeitschift fur Metallkunde
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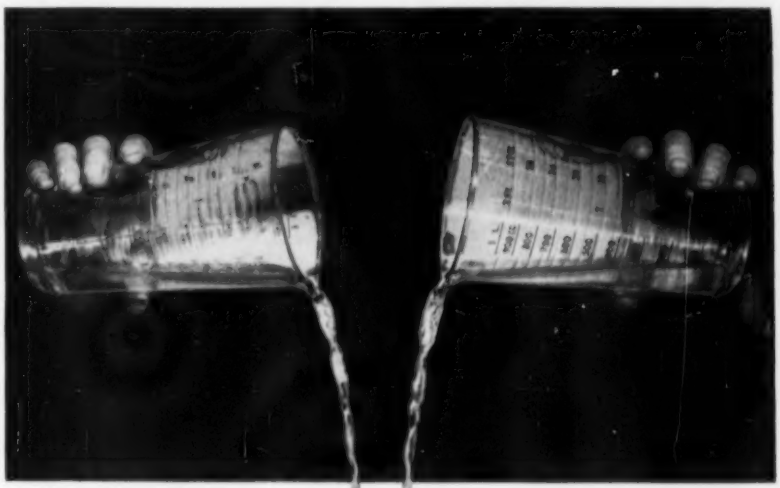
Germany



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E—1207. Anode Bag—Ease of handling, long life, and lab inspected cloth engineered for specific service are three features of Easy-tie anode bags, introduced by Hanson-Van Winkle-Munning Co.

Heavy duty strings attached to the bag top are drawn around and tied once. The operation holds the anode bag securely, eliminating tucks, eyelets or stitching used on most bags. The new bags are easily opened for inspection.

Each lot of fabric is tested to insure complete freedom from contaminating impurities. The H-VW-M bag is manufactured in any length or width in a wide range of materials. Materials are "laboratory matched" to specific plating requirements.

The new bag is completely desized and pre-shrunk. The company announced extensive tests of the new bag were held under actual production conditions before its introduction.

E—1208. Cleaning Machine—The Magnus Chemical Co., Inc., announces a new machine for washing tote boxes and small metal parts of various shapes and dimensions. Loading and unloading of the machine is accomplished at the same end by one operator.

In this machine power spray washing is combined with dip-immersion-agitation.

Small parts, loaded in baskets, are washed and rinsed using vertical agitation at the rate of 25 baskets per hour, using the dip-immersion-agitation method in which the basketed parts are moved rapidly up and down in the solution.

The basketed parts are automatically transferred from point of loading through the wash and rinse stages to the unloading station. The immersion and agitating period in the wash and rinse stages is controlled by an adjustable timer.

E—1209. Black Wax—The Rollo Chemical Co. announces the availability of a new product, Rollo Black Wax. This product is for black oxide or phosphate finishing operations where a decorative, durable hard black wax final finish is required.

It is claimed to produce a satin black finish that not only enhances the appearance but increases the salt spray resistance up to 16 hours. Work may be processed in bulk without fear of contact marks, tears, or of having parts stick together. It is used as received and may be applied by either dipping, spraying, or brushing. Drying time is usually under five minutes.

E—1210. Coating for Metallizing Cast Metals—A new coating, formulated for use on cast metals which are to be vacuum metallized, has been developed by Schwartz Chemical Company, Inc.

The coating, known as MC-30, can be used both as a base coat and top coat in the metallizing of cast metals, according to the manufacturer.

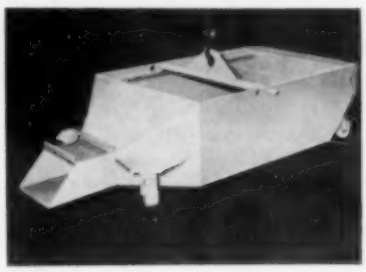
The new lacquer reportedly cures to a hard, glossy, solvent resistant coating.

E—1211. Liquid Paint Stripper—Cleanite 56, a liquid paint stripper for lacquers, vinyls and baked enamels is announced by Cleanite Products Inc. The solution does not have to be heated and works in one to two minutes at room temperature. It is reported to be safe on aluminum, copper, brass, zinc and steel.

E—1212. Pad and Discs for Contour Polishing—For contour grinding or polishing in small radii or difficult contours with portable tools, a new mushroom shaped molded rubber pad and coated abrasive discs have been developed by Behr-Manning Co. division of Norton Co.

The new discs and pads, available in diameters of 5 and 8 in., were designed specifically for getting into contours where disc pads of conventional type may not perform effectively. With the new pad, it is possible in many cases to do an entire contour in one operation. Also, swirl marks and gouges are virtually eliminated, so that the usual subsequent finishing operation can often be dispensed with.

E—1213. Hopper Pans—Three hopper pans to speed loading, unloading, storage and transfer of tumble-finishing media are now available from Rampe Manufacturing Co. All are constructed of heavy-gauge steel plate. Typical uses of the pans include hopper loading of steel balls or



heavy abrasives from storage bins into tumbling barrels, unloading large capacity machines, and rolling pans from bin to bin in preparing special media mixtures.

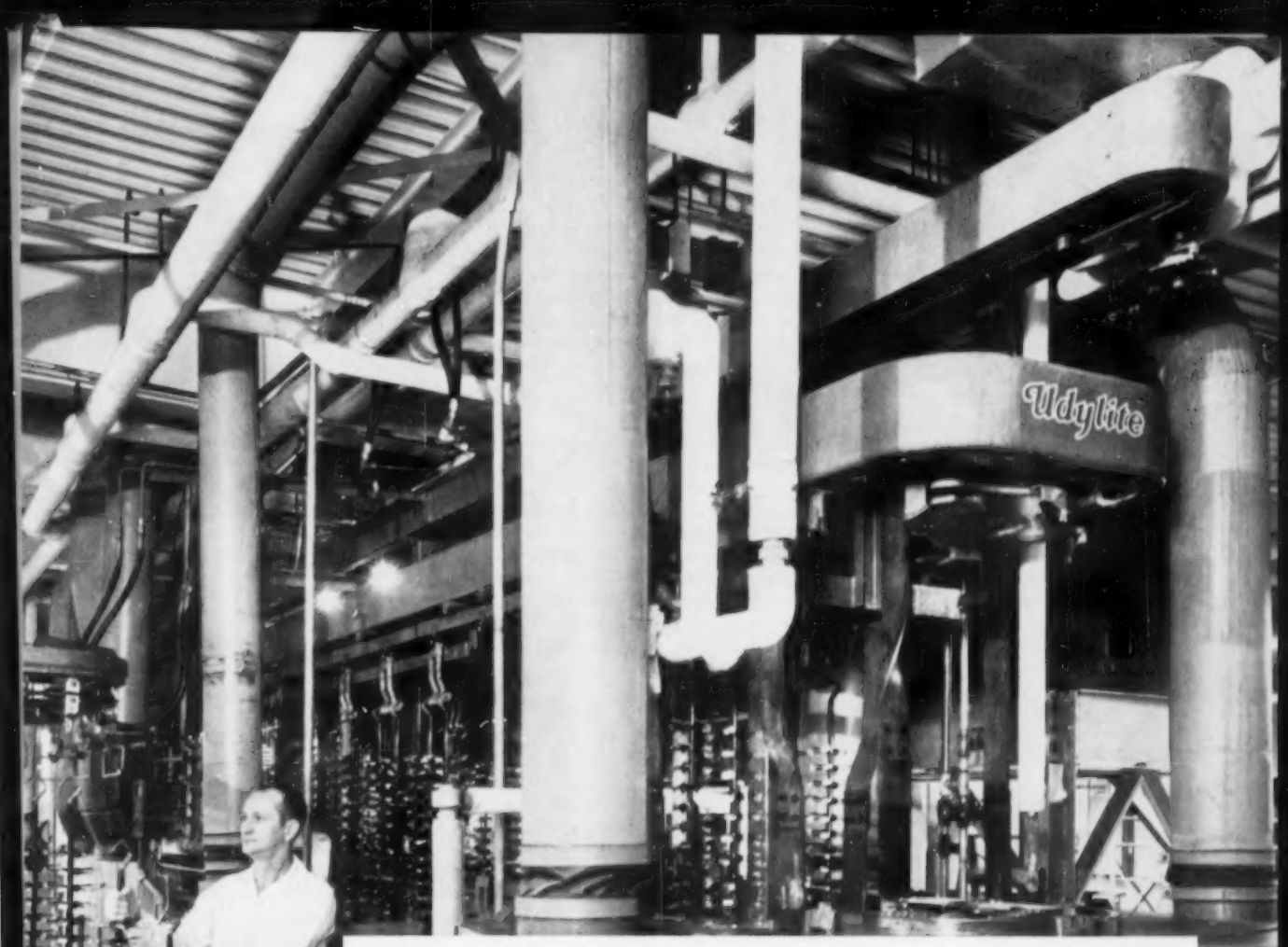
E-1214. Burnishing Compound—The Esbec Barrel Finishing Corporation has announced Esbec No. 203, a burnishing compound which is said to represent a new development in the barrel finishing field.

It is a fine, non-dusting, non-abrasive, highly concentrated powdered compound designed for high lustre burnishing in aluminum oxide chips and in molded shapes.

Esbec No. 203 is a dual action burnisher as it can be used for "cut and color" operations where deburring and burnishing is done in one operation in aluminum oxide media. By eliminating separate cut, rinse and burnishing cycles, savings are made in both man hours and material.

E—1215. Alkaline Derusting Compound—Heatbath Corp. announces a new alkaline derusting compound, Derustal. It is an alkaline material for use in removing rust, scale, paint, enamel, lacquer and oil from ferrous metal without any attack on the base metal. Derustal can be used to replace acid pickling operations, eliminating the hazards of pitting the parts to be cleaned and eliminating hydrogen embrittlement of high carbon steel and spring parts. It is a free flowing powder and is used 1 to 3 lb. per gal. of water at a temperature of 180 F to boiling.

E—1216. Vacuum Metallizing Unit—A complete redesign of the vacuum pumping system of its Model 427 72-in. large-scale production vacuum metallizing unit has been carried out by the High Vacuum Equipment Division of F. J. Stokes Corp. The new design is said to achieve faster evacuation of the chamber and permits shorter metallizing cycles and greater productivity. Simplification of the pump-



Udylite Machine and Process combine to set new Scripto standards

The Udylite Cyclemaster provides the accuracy and steady flow of production. Udylite Bright Nickel furnishes the sparkling finish. Together they solve for Scripto, of Atlanta, Georgia, the knotty problem of better finish of the Scripto pens, pencils and cigarette lighters.

Scripto's first bright nickel was the Udylite #31 process. It was superseded by the Udylite #514 process to gain the faster brightening which is so important in nickel plating to a high luster with a thin coat.

The adoption of Udylite Bright Nickel Process #724 was the next step as it offered still faster brightening and even more important all the time saving advantages of all liquid brighteners.

Step by step Scripto has lowered costs and improved quality with Udylite Processes and Precision Automatic Plating. Here is just one of many examples of the right application of process and equipment. Out of the line of Udylite products can come the answer to your problem as well.

Contact your local Udylite Sales Representative . . . let him show you how the *right* combination of Udylite processes and machines can improve your quality and production.

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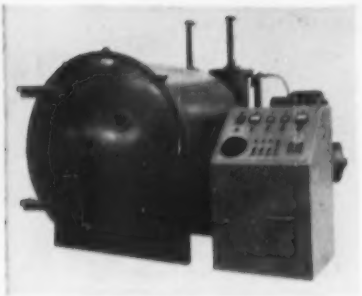


ing system through the use of fewer but larger capacity diffusion pumps eliminates certain vacuum valves and connections and reduces piping.

The redesigned Model 427 unit has two 16-in. diffusion pumps and a 6-in. booster pump which backs up the diffusion pumps.

Pump-down time to 0.5 microns (normal "flashing" pressure) has been reduced to six minutes or less and the pumping system is better able to handle unusual operating conditions such as heavy outgassing from the work or from contaminated chamber walls.

E—1217. Protective Coating—Mono-Seal Products has announced a new plastic-type protective coating formulated from a blend of silicones and epoxies. It has a natural "stretch" and will not chip or peel when bent or dented.

Mono-Seal is described as a balanced chemo-setting synthetic resin coating containing the newly discovered silicones and epoxies. It cures both by solvent evaporation and internal polymerization.

The non-aging properties and surface hardness and elasticity provide the type of coating that will protect against acids, alkalies, oils, solvents, plastercizers, moisture, weathering, abrasion, impact and temperature extremes.

E—1218. Zinc Brightener—R. O. Hull & Co., Inc., have recently announced a new 503 zinc brightener for still and automatic plating.

This 503 zinc brightener is a balanced liquid formulation which augments the line of other Rohco zinc and cadmium brighteners now used by the plating industry. According to the manufacturer, Rohco 503 has been proven in 150,000 gal. of zinc solution and offers: stability, since it resists break-down at high temperature giving peak economy of operation—generally 50,000 or more amp hr/gal; brightness with uniformly high luster, from high current densities into the deepest recesses; covering power in deep recesses and high carbon steels; fine grain for maximum luster, corrosion resistance and acceptance of chromate conversion coatings or black finishes.

E—1219. Vinyl Texture Finishes—The eye appeal of textured finishes is claimed to be combined with the durability of vinyl plastisols in "M&T Armorhide", most recent addition to the line of Unichrome organosols offered by Metal & Thermit Corp.

The pattern of the finish hides imperfections in the metal surfaces to which it is applied, eliminating need for special surface preparation.

Armorhide provides a spray-applied finish resembling grained leather and is available in a wide selection of colors.

Ease of application is claimed. A special air flash primer is the first step. Next "Armorhide" is sprayed to a thickness of from 2 to 40 mils, in one or more coats depending on requirements. After a 1-minute flash-dry, M&T Texture Agent is sprayed over the entire surface of the "Armorhide" film. The coating is then cured at 350F for approximately 15 min.

E—1220. Automatic Timing Unit—R. E. P. Electric Products Co. has announced a new Cyclomatic Timer, an automatic timing unit for electroplating plants. It automatically starts timing as soon as work is put into the plating tank and signals with buzzer and light at the

end of the preset time. The signalling continues until the switch is turned off or the work is removed from the tank. The timer automatically resets for the following cycle. It is manufactured in a wide range of ampere capacities and timing cycles.

E—1221. Ultrasonic Generator—A new ultrasonic cleaning generator for pilot-plant or production application has been developed by Branson Ultrasonic Corp. Designed to simplify manual or conveyorized cleaning and degreasing, the model AP-200 Sonogen is 25 by 17 by 19 in. high, weighs 175 lb. has an average power output of 1 kw with a peak on pulses of 4 kw and plugs into all standard indus-

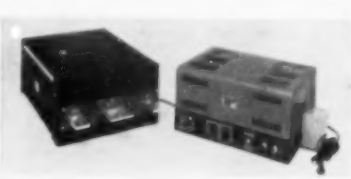
trial receptacles. Housed in a gray hammertone aluminum cabinet, it has a simple one-tube pulsed oscillator, a number of heavy-duty components and a cooling fan to insure long trouble-free operation in continuous production.

E—1222. Automatic Transfer Unit—Design principle of a new fully automatic transfer unit, developed recently by Wagner Brothers, Inc., is claimed to be readily adapted to practically any mechanized materials handling transfer problems.

All mechanism of the unit, which operates on a track, is confined within the transfer carriage to make a completely self-contained unit. In operation, the transfer setup picks up the work from the two conveyor hooks and transfers it to the work-carrier hooks — upon which the unfinished work is moved out of the loading station by the machine, and the finished work moved into its place.

The transfer unit, which dwells during the machine index, then moves to the left, transferring the two finished work racks from the machine work carrier hooks onto the two empty hooks of the conveyor—which in turn had remained stationary during the preceding motion. The finished work is now indexed out of the conveyor loading station and the unfinished work moved into its place.

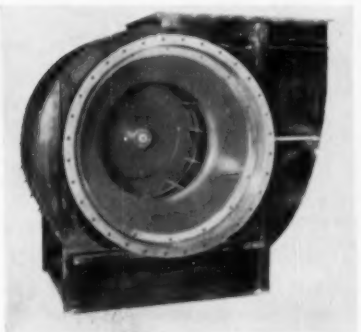
E—1223. Solenoid-Operated Switchgear—New Developments in heavy DC current switching at low voltage are featured in a new product being offered by Unit Process Assemblies, Inc. Equipment in capacities from 50 amp to as high as 35,000 amp is made available, and features



low initial cost. This solenoid-operated switchgear is offered in a variety of switching systems for use with all DC rectifiers and generators and can be equipped with timing controls.

Some of the many applications in industry include: DC switching for refining and electrolyte processes; periodic-reverse electroplating processes; DC polarity reversal in hard chrome plating, alkaline derusting and descaling and electrocleaning; switching in low voltage DC furnaces for melting and sintering.

E—1224. Exhaust Fan Lining—The Ceilcote Co., Inc., announces a new application for their recently developed Coroline corrosion-proof thermo-setting material. This new product can be utilized to cover housing and fan blades of a corrosive atmosphere expulsion fan.



It is brush applied to a total thickness of 1/8 in., after surface preparation by sand blasting. Because curing is slow below 70F, portable heaters are utilized and total setting effected in approximately 30 hours.

The coated exhaust unit is equipped with a greatly extended working life in the handling of fumes and vapors from chemical processing tanks, chemical storage areas, plating tanks and dip tanks.

E—1225. Industrial Gloves—North PVC-coated industrial gloves, said to be the most abrasive and chemical resistant and most flexible on the market, have just been introduced in the United States by Jomac Inc.

Tests have shown that tough, abrasion-resistant North PVC gloves last from two to five times longer than many types of rubber, leather or coated gloves and save from 50 to 90 per cent in replacement costs.

They resist chemicals and solvents encountered in industrial use, including acids, alkalis, fats, greases, oils, petroleum products, alcohols and waxes.

They are claimed not to crack or peel and are non-flammable and non-oxidizing.

North PVC gloves are furnished in a wide variety of styles for every requirement, including gauntlet, knitted wrist, ribbed surface and either fully coated or palm coated.

E—1226. Metal Cleaner—Alkaline solutions of Maracarb N reportedly remove dirt and oil films from metals, and by chelation put tarnish and oxides into solution without harming metal.

Maracarb N, a product of Marathon Corp., is a mixture of the sodium salts of lower molecular weight lignosulfonic acids and the salts of alkaline reversion products of hexoses and pentoses.

The electronegative potential capacity of 10 per cent Maracarb N solutions ranges from -300 mv at 8 pH and room temperature to -550 mv at 11 pH and 70C. Aging the solutions for one week produces very little drop in the electronegative potential capacity, indicating a long life in metal cleaning baths.

E—1227. Germanium Power Rectifier Junctions—Designed for application to heavy duty electrochemical, metal refining and similar installations requiring exceptionally high current at low voltage, International Rectifier Corp.'s 500 amp germanium power rectifier junctions provide efficiency of 98.9 per cent. The cast aluminum airfoil housing, measuring 6 in. by 6 in. by 4-5/32 in., removes heat from the all-welded, hermetically sealed junction at an optimum rate; leads to marked economies in space and weight of installed rectifier equipment. Long-term reliability stems from improved methods in the diffusing of the junction, which is alloyed during the hermetic sealing, without the use of active chemicals.

The employment of advanced ceramic techniques has resulted in a junction free of internal stresses, enabling it to withstand the severe thermal shock encountered when subjected to excessive surge loads.

These 500 amp junctions are available in six types, with input voltages ranging from 20 to 66 volts rms.

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Part of the gathering of members, national officers and guests at the Mohawk Valley Branch installation dinner meeting.

Proud moment for Mohawk Valley Branch. National President Francis T. Eddy, left, presents permanent charter to Branch President Francis A. Czech.

MOHAWK VALLEY INSTALLED AS AES's 57th BRANCH

Granted a permanent charter by the Executive Board at its last meeting, the Mohawk Valley Branch was formally installed as the 57th Branch of the American Electroplaters' Society (AES) at a banquet and impressive installation meeting held at the Hart's Hill Inn, Whitesboro, New York, November 14. National President Francis T. Eddy installed the Branch and presented it with its framed Charter. Branch President Francis A. Czech accepted in behalf of the dynamic infant Branch whose membership has already risen to 52 members.

A full turnout of Mohawk Valley Branch members, together with a number of representatives of Branches near Utica, N. Y., including Syracuse, Capitol District, Southern Tier and others, were present at the banquet and ceremony. Beside President Eddy, the installation team included Third Vice President W. Andrew Wesley and Executive Secretary John P. Nichols. Also present was Rodney Leeds, editor of PLATING. Jack Bension, Branch second vice president, served as toastmaster.

Branch President Czech's welcome and opening remarks were followed by a brief talk by former Mayor and current Utica Chamber of Commerce head Vincent Carrou who congratulated the new Branch in behalf of Utica. Branch Secretary Charles P. Raehm Jr. then highlighted the background of the Branch.

Dr. Wesley briefed the Branch on the responsibilities of a Branch to the AES and its members, and Mr. Nichols summarized the relationship of National Headquarters and AES Branches. President Eddy then made the principal address and installed the group as the Society's 57th chartered Branch.

Third Vice President W. Andrew Wesley tells the new Branch of its responsibilities. National Executive Secretary John P. Nichols, center, and Branch Vice President Charles A. Bridgett.

Delegates and Alternates receive Delegates Manual from President Eddy. Left to right, Robert Stewart, Delegate; President Eddy; Francis A. Czech, Delegate; Jack Bension, Charles P. Raehm Jr. and Walter Sackett, all three Alternates. Not present when picture was taken, Mervin Warren, Delegate.

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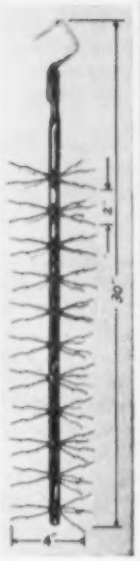

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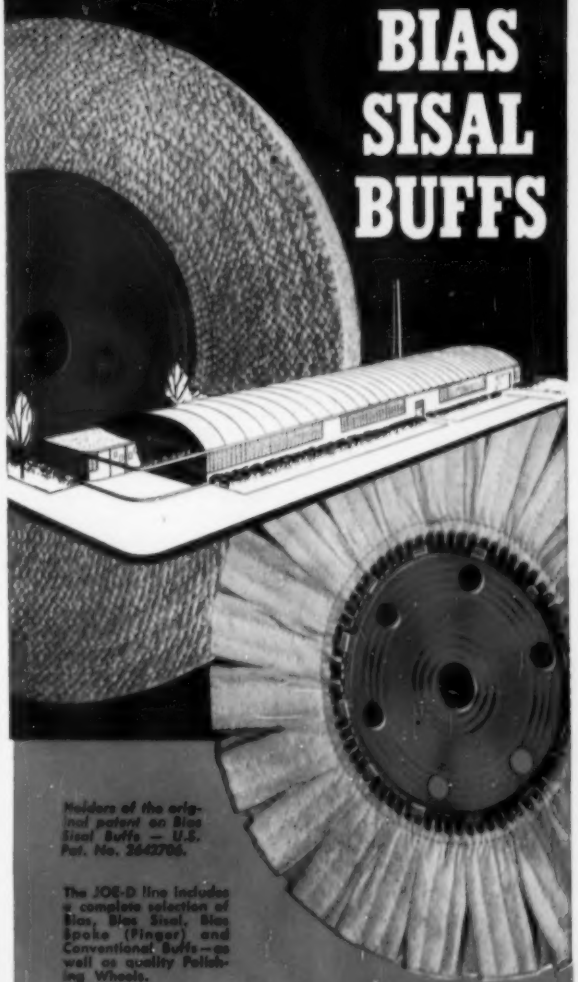

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PERSONALS

Donald F. Cooper, formerly of the Celite Div. of Johns-Manville Products Corp., has been appointed sales manager of the Industrial Division of Sparkler Manufacturing Co., Mundelein, Ill.

While with Celite, Mr. Cooper was a familiar figure in the plating and paint industries in the Michigan area. He holds a BS degree from Lehigh University.

D. F. Cooper

C. E. Ewing

Charles E. Ewing has been named Industrial Division salesman for Sparkler Manufacturing Co. for the State of Michigan.

A chemical engineer graduate from Eastern Michigan College, Mr. Ewing served for the last four years as head of the Chemical Processing Laboratory at A.C. Spark Plug Div., Flint, Mich.

R. D. Bradford, vice president and director of American Smelting and Refining Com., has been placed in charge of the company's Federated Metals Division.

The Federated Division, which has 24 plants in the United States, produces brass and bronze, aluminum and zinc alloys, type metals, plating supplies and electrochemicals, zinc and magnesium galvanic anodes, solders, babbitts and other nonferrous metal supplies.

A native of Salt Lake City, Mr. Bradford holds an MS degree in Mining and Metallurgical Engineering from the University of Utah. He joined ASARCO in 1926 as a junior metallurgist at the Garfield, Utah, smelter. From this position he rose rapidly through various departments to his present position.

George T. Hubbell has been elected president and **T. Mark Keefe** as executive vice president and treasurer of The Seymour Mfg. Co., Seymour, Conn.

Mr. Hubbell presently is serving as president of American Refractories & Crucible Co., North Haven, Conn. Prior to joining Seymour, Mr. Keefe was an executive of Mullite Refractories Co. He previously was a vice president of The Bankers Trust Co. and an officer of the New York Trust Co., both of New York City.

Roy E. Slipiec has recently been named midwest sales representative of Geigy Industrial Chemicals, Division of the Geigy Chemical Corp., Ardsley, N. Y. His sales headquarters are located at 629 West Washington Boulevard, Chicago, Ill.

Mr. Slipiec attended Wright Jr. College, the University of Illinois and Roosevelt University of which he is a graduate. He was formerly associated with the Gallowhur Chemical Corp. of Ossining, N. Y. and the Movidyn Corp. of Chicago. He is a veteran of World War II during which he served with the Army Medical Corps in the South Pacific.

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G. E. Landis

D. S. Weir

George E. Landis recently joined Wyandotte Chemicals as industrial sales representative in the Boston, Mass. area covering also Providence, R. I. and surrounding territory.

Mr. Landis attended University of Nebraska and York College receiving his BS in chemistry from the latter. He served six years in the Armed Forces and has represented three nationally known firms.

Before being assigned to the Boston district, Mr. Landis was given intensive Wyandotte training.

Charles H. Sawyer has been appointed sales coordinator for North PVC products by Jomac Inc., Philadelphia, Pa.

North PVC products are manufactured by Jomac-North, Inc., a firm recently organized by Jomac Inc., and James North & Sons Ltd., London, England. The products are coated work gloves, aprons and chemical resistant clothing.

Donald S. Weir has joined the Rapid Electric Co. in the capacity of general manager, Connecticut division.

Formerly associated with Hanson-Van Winkle-Munning Co., for the past 25 years, most recently as plant superintendent, Mr. Weir will organize Rapid Electric's planned manufacturing facilities in Connecticut.

Preliminary plant construction surveys are under way on a purchased 25-acre tract located in Danbury. Plans call for mass production of DC power supplies for the industrial and plating fields.

Joseph Muscarella has been appointed sales representative for Hanson-Van Winkle-Munning Co. in the Kentucky-Tennessee area. His headquarters will be at 366 Francis Building, Louisville, Ky.

Prior to his appointment, Mr. Muscarella spent four and a half years as sales engineer, general equipment, in the company's main office at Matawan.

Mr. Muscarella has a background in barrel and general plating equipment

W. G. Anderson

J. Muscarella

sales. A member of the AES, he studied at Rutgers University.

William G. Anderson has been appointed advertising and sales promotion manager for Frederic B. Stevens, Inc.

In his new capacity Mr. Anderson will direct all advertising, promotion and publicity activities for the 75 year old Stevens Company.

Prior to joining Stevens, he was sales promotion manager for the Fruehauf Trailer Co.

Mr. Anderson is a native Detroiter and attended Wake Forest College and the Detroit Institute of Technology. During World War II he served for four years in the U. S. Air Force, spending two years in the C.B.I.

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J. B. Kushner

D. H. Kinder

Joseph B. Kushner, director of the Joseph B. Kushner Electroplating School, 115 Broad Street, Stroudsburg, Pa., was awarded the degree of Doctor of Philosophy in Metallurgical Engineering at Lehigh University on October 13.

Dr. Kushner's dissertation, "A Critical Evaluation of Some Factors Affecting Residual Stress in Electrodeposited Metals" uncovered a number of facts regarding stress in electroplated metals and proposes a new theory to explain the origin of these stresses which very often can cause plating difficulty in the form of peeling, crack and blistering, as well as difficulty with distortion and reduction in fatigue strength in basis metals plated for engineering purposes.

Dr. Kushner also holds a chemical engineering degree from the Cooper Union Institute of Technology and a Masters degree in metallurgical engineering from Lehigh. Prior to starting the school which specializes in home study courses in modern electroplating and metal finishing, some ten years ago, he acted as a consultant to the industry. During the war years he served as senior electrochemical engineer on the SAM Branch of the Manhattan District project at Columbia University and was awarded a bronze medal for his services. Before that Dr. Kushner worked for many years in the industry as an electroplater, electrochemist and engineer.

David H. Kinder has been named research and development chemist by MacDermid Incorporated, Waterbury, Conn. He will work in MacDermid's laboratory on a new line of chromate conversion coatings.

For six years prior to joining MacDermid, he worked as a development engineer for Allied Research Products, Baltimore, Md., on the development of chromates.

P. H. Richey, executive vice president of Wagner Brothers Inc., Detroit, has been named president and treasurer of the company's newly-acquired, wholly-owned subsidiary, Automatic Molding Machine Co. of Los Angeles, Calif.

Morton Schwartz, senior electrochemist; **Fred Larsen,** physical chemist; **Bruce Davis,** inorganic chemist; and **Ronald North,** senior analytical chemist, are new appointees at Kelite Corporation's Research and Development Laboratories in Los Angeles.

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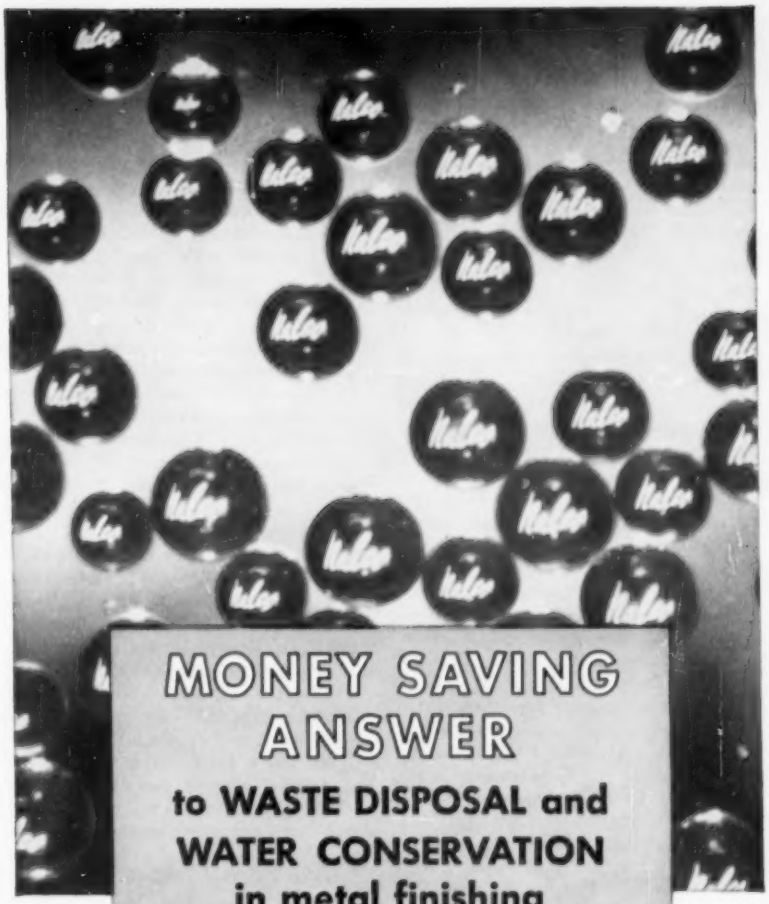

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JANUARY 1958

ABRASIVES AND MECHANICAL FINISHING. Third annual issue of this popular yearly feature.

●

MARCH 1958

ORGANIC COATING. Like last year's edition, this issue will feature organic finishing.

●

APRIL 1958

TECHNICAL RESEARCH. Not only will this issue spotlight recent developments in the AES Research Program but will also be the pre-1958 ANNUAL CONVENTION feature issue.

●

MAY 1958

CONVENTION ISSUE. Inasmuch as the 1958 Annual Convention will be held in Cincinnati, Ohio, May 19–22, this feature issue will come in May instead of June as customary.

●

JULY 1958

POST CONVENTION ISSUE. Among other features, it will contain a pictorial and narrative account of the 45th Annual Convention.

●

AUGUST 1958

WATER AND WASTE TREATMENT. Another edition of this informative and popular feature.

BRANCH NEWS

Total AES Branches U. S., Canada, Australia, October 1, 1957—57.

BRIDGEPORT

Cavanaugh Speaks at Lively Session

The regularly scheduled business meeting and educational session of Bridgeport Branch was held in the "Winter Quarters" of the Hotel Barnum on Friday, October 11, 1957. The meeting was called to order by President **Floyd Tatum.** One new member was accepted. **George Eckholm** appointed his Christmas Dinner-Dance committee. The affair is scheduled for Dec. 14 at the Hotel Barnum.

Bill Lindsay reported that the final meeting of the 18th New England Regional was a financial success. Accolades were showered on **Robert Bonazzo** for his efforts as chairman of the program committee. At this meeting, an invitation to merge with the Boston Branch was rejected by a 3-2 vote. The incumbent slate of Delegates and Alternates was reelected to represent Bridgeport.

The featured speaker of the evening was **George W. Cavanaugh.** His talk "What Parliamentary Law Means to Your Branch," proved to be one of the most interesting heard at Bridgeport Branch. He held the interest of the audience so completely that we reluctantly permitted him to conclude his talk. Lively questions and answers interspersed his talk. Mr. Cavanaugh received a very sincere rising vote of thanks for coming down from Syracuse to talk to us.

President Tatum appointed a committee to investigate the feeling of the Branch members toward holding an annual meeting, the costs involved, etc.

The door prize was won by **Hugh Morris.**

Bob Parker
Secretary-Treasurer

BUFFALO

Biebel on Barrel Finishing at Jamestown Meeting

The second meeting of the season of the Buffalo Branch was held at Jamestown Oct. 4, 1957, with another record crowd.

After a delicious dinner of either roast beef or lobster tails, topped by delectable strawberry ice cream pie, **William Biebel** of the Esbec Barrel Finishing Corp. of Byram, Connecticut, gave an interesting and highly informative talk on "The Variables of Barrel Finishing." With a wealth of experience and research in the field of barrel finishing, the speaker answered numerous questions following the talk.

Bert Kirchoff of Jamestown Plating Co. showed a series of colored slides he had taken this spring while on a trip to England and the continent, particularly his native Switzerland.

Thanks, Jamestown, for being such a good host.

Ralph D. Stemmerich
Secretary

CAPITOL DISTRICT

Nichols Presents Functions of National Headquarters

The October meeting of the Capitol District Branch was held at Panetta's Restaurant in Menands, New York, on Oct. 7. President **Robert Wolf** introduced Executive Secretary **John P. Nichols,** who spoke about the functions and activities of National Headquarters.

Mr. Nichols and the members present held a round table discussion in which Mr. Nichols answered questions of members.

A very enlightening discussion followed in which all present participated. Brought up was the obvious problem which we have in getting members out to meetings. This problem was discussed and several possible solutions were brought forth. The possibility of making our meetings more interesting through more plant visitations and the possible inclusion of a larger amount of information on organic finishing were highlighted.

William R. Allison
Secretary

CENTRAL MICHIGAN

Anodizing Subject of Darrow's Paper

Central Michigan held its first dinner and educational meeting of the 1957-1958 year on Tuesday evening, Oct. 1, 1957.

Dinner was followed by an educational meeting at the Roosevelt Hotel in Lansing, Michigan.

Speaker for the meeting was **G. R. Darrow,** finishing engineer, Reynolds Metals Co. He spoke on "Special Techniques and Procedures in Anodizing of Aluminum." A very informative and lively question and answer period followed. Thirty-seven members and guests attended this first meeting.

Homer E. Welch
Third Vice President and Publicity Chairman

CHICAGO

Precious Metal Symposium

The technical program, for the October meeting which was held on Friday, Oct. 4, 1957, was a symposium on "Precious Metal Plating". The speakers were **Frank Smith,** Technic Inc.; **Edwin Rinker,** Sel-Rex Corporation; and **Roger Zylstra** of the Ford Motor Co., Air-Craft Engine Division, Chicago.

The first speaker of the evening was Frank Smith who talked on "Gold Plating". Mr. Smith has set up many installations for gold plating in the decorative and industrial fields. In the decorative field, gold deposits are extremely thin while the industrial applications range from 0.000020 to .005 in. He discussed the various metals such as nickel, cobalt, silver, which are added to gold baths to obtain certain physical properties. For example: nickel and cobalt increase tarnish resistance and hardness. Gold-silver alloys increase with hardness in silver content. Mr. Smith also discussed the various uses of gold-alloy plate for the electronic industry.

Edwin Rinker gave a talk on "Rhodium Plating". Mr. Rinker was instrumental in setting up the first industrial plating of rhodium. The plating bath developed yields deposits which are compressively stressed and eliminates rejects due to cracking and peeling of the deposit. Rhodium is applied directly over nickel, palladium and gold alloys.

The baths are available in the phosphate and sulphate formulations. Mr. Rinker also discussed the various alloy-gold baths for specific applications in the electronic and electronic-aviation fields.

Roger Zylstra talked on "High Speed Silver Plating". With the use of slides, Mr. Zylstra discussed the various parts which were silver plated for use in the jet-engine. Silver plate was used (1) for high temperature application and (2) because of its softness to prevent galling. The baths were agitated and filtered continuously to produce a smooth plate at high current densities.

Christopher Marzano
Publicity Chairman

CHICAGO

Weeg Discusses Barrel Finishing

The regular meeting of the Chicago Branch was held at the Western Society of Engineers on Friday, Nov. 1. The technical program began with **Dr. Russ Harr** introducing the speaker of the evening, **Leonard Weeg.** Mr. Weeg is superintendent of finishing at National Lock Company in Rockford, Ill. His subject was "Barrel Finishing".

Mr. Weeg explained in some detail the various types of barrels used for barrel finishing of parts. The type of material to use in the barrels depending largely on the nature of the part. The type of material employed may be (1) natural stone, (2) aluminum oxide, (3) steel balls, (4) wood pellets, (5) cloth, (6) leather, (7) sand, (8) pumice and (9) the work itself.

The drying of the parts after burnishing is of extreme importance to help prevent the corrosion of the parts during storage prior to plating. Drying is accomplished by use (1) of a centrifugal dryer, (2) dipping in a displacement solvent and (3) by tumbling in sawdust. Corn-cob meal is preferred over saw-dust as a media for drying.

Mr. Weeg pointed out that experience is necessary in any barrel finishing operation and that labor and materials are the primary costs to be considered. The different types of hardware as processed by the finishing department were then circulated throughout the audience and a question and answer period followed.

Christopher Marzano
Publicity Chairman

CINCINNATI

Visit Armco Steel Show

On Oct. 23 36 members and guests of the Cincinnati Branch journeyed to Hamilton, Ohio for dinner at the Eaton Manor and a short meeting during which two applications were approved.

The group then proceeded to the Middletown plant of Armco Steel for an inspection trip. The two and one-half hour tour visited all of the operations at the mill, including the very impressive sight of an open hearth furnace being tapped.

It was the consensus of the group, that this was a very interesting and educational inspection trip.

David L. Kaplan
Secretary

CLEVELAND

Combs Predicts "Startling" Chrome Plating Future

"Chrome Plating Up-to-Date" was the subject of the talk presented to the branch at the regular monthly meeting by **Gene Combs.** Mr. Combs reviewed recent developments in both the decorative and hard chrome plating fields. It was stated that the next ten years will see startling developments which today are not even dreamed of. Background on the manufacture of chromic acid was also included in the talk.

Plans are now set for the annual dinner dance. It will be an event of February 15 at the Rainbow Room of the Hotel Carter. Social Chairman Henry Sedusky is heading up the arrangements for the affair.

During the evening business session the branch voted to submit the name of Dr. William Blum as its nominee for the first Dr. Blum Achievement Award.

Gordon H. Carlson
Assistant Librarian

CLEVELAND

Arndt Speaks on Ventilation; Annual Dinner-Dance Planned

The English Room of the Carter Hotel was the scene of the regular monthly meeting of the Branch. The speaker for the evening was **Fred W. Arndt,** chief engineer of the Heil Process Equipment Co. His topic was "Plating Room Ventilation".

Arndt pointed out that sound engineering of a plating room ventilation system might reduce the volume of air requiring exhaustion by as much as eighty per cent. The importance of using the proper materials of construction in a ventilating system was also stressed. It was pointed out that with certain materials, engineering considerations other than ventilating, viz., weight and construction, become of major consequence. Discussion also brought out the prominence air pollution considerations are beginning to play in the problem of plating room ventilation. Three new members were received into the branch.

Henry Sedusky, chairman of the social committee, reported that plans for the Annual Dinner Dance were nearing completion. **John Bohovic** has completed the selection of the entertainment and

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Sedusky, together with **Charlie Ott**, has approved the dinner menu.

The door prize, a handsome traveling alarm clock, was won by **Gordon Carlson.**

Gordon H. Carlson
Assistant Librarian

Cleveland Branch

Research Fund Donation

The Cleveland Branch approved a donation of $500 from the Branch treasury for the Society Research Fund at its recent November meeting according to Morton Van Loan, Branch President. The approval came following a recommendation by the Executive Committee. The universal benefits from the research program to all phases of the electroplating industry were expressed by various members present at the meeting.

COLUMBUS

Faust Proposed for Scientific Achievement Award

The regular monthly meeting of the Columbus Branch was held on Friday, Oct. 4, in conjunction with a tour of the Ternstedt Division, General Motors Corp. plant.

The business meeting was called to order by President **Calvin Smith.**

The minutes of the September meeting were read and approved. Three candidates were approved and elected as members.

Dr. Charles Faust was endorsed by the Columbus branch for the Scientific Achievement Award (William Blum Lecture) at the national convention.

A motion was made, seconded and approved that every other meeting of the Columbus Branch should be a dinner meeting.

Following a tour of the plant and a question and answer session, the meeting was adjourned.

Halvor S. Christianson

DAYTON

Phosphate Coating Presented by Gibson

The Dayton Branch held their regular October meeting at the Dayton Biltmore, Oct. 16, 1957. Thirty-one members and guests were in attendance.

Due to the recent serious illness of our librarian, **Albert Wendt**, a new librarian was elected—**Norbert A. Mollmann**, of the National Cash Register Co.

The same delegates and alternates were retained by election inasmuch as they had only served a part of a year. They are: **Jack Baker, John Easton** and **Robert Ruleff** as Delegates and **Bennie Cohen, Byron Bowman** and **Hollie Luechauer** Alternates.

The speaker for the evening was **Dr. R. C. Gibson,** assistant vice president, Parker Rust Proof Co., Detroit, Mich. His topic was "Phosphate Coating of Metal Surfaces". The talk was accompanied with many slides and samples. By the lengthy question and answer period, it can be said that it was a very interesting and timely subject.

Refreshments after the meeting were also through the courtesy of Parker Rust Proof Co. and their local representative and Dayton Branch member, **Gustave D. Wendt.**

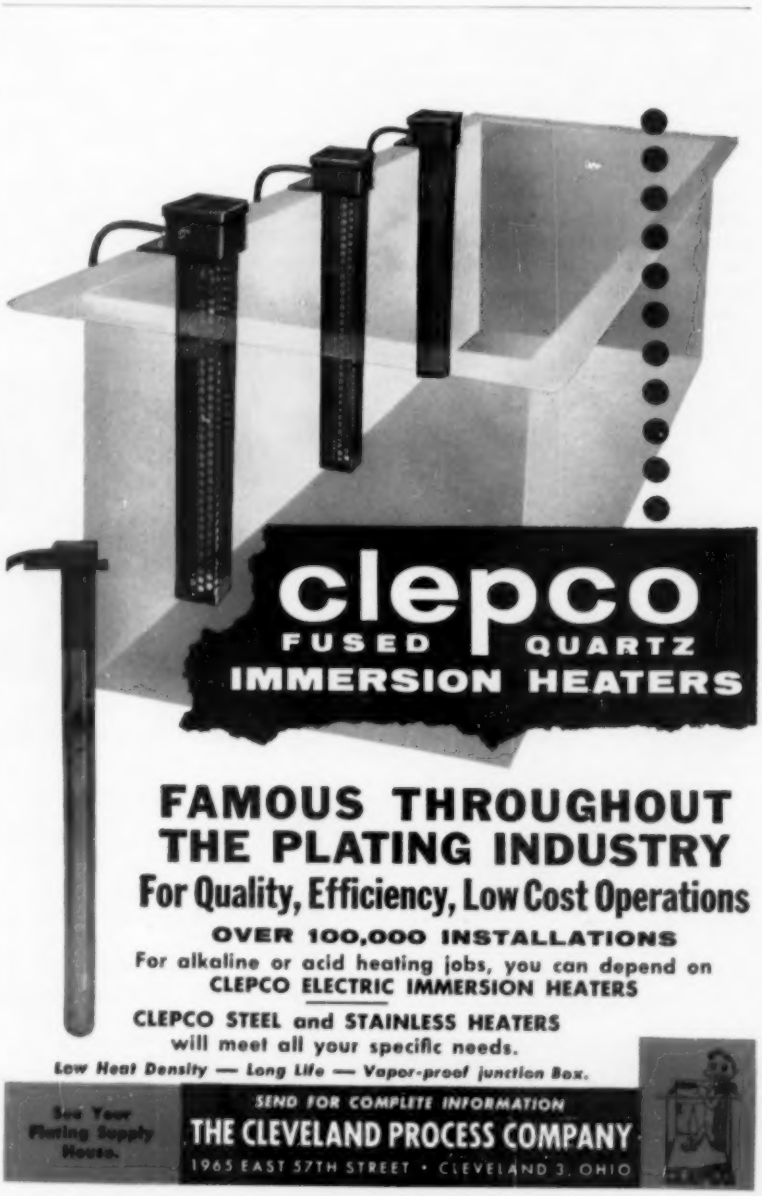
R. M. Clinchens
Secretary

DETROIT

Pinner Reports on B-8

The second fall meeting of the Detroit Branch was held at the Statler Hotel in Detroit on Oct. 4, 1957.

President **Glenn H. Freidt Jr.** opened the meeting at 8:25 p. m. and greeted the 115 members and guests present.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Remittance must accompany all book orders placed with AES Headquarters.

Preparation of Protective Coatings by Electrophoretic Methods by A. C. Werner and others, Vitro Corporation of America for Wright Air Development Center, U. S. Air Force. April 1957. 53 pages. $1.50. Order PB 131062 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Electrophoretic methods were tested for the preparation of protective coatings which would make molybdenum suitable for continuous, long-term operation in an oxidizing atmosphere at 1800 to 2000F. Multilayer coatings of 80 per cent nickel-20 per cent chromium and nickel-bonded chromium carbide provided good static air-oxidation resistance. Inclusion of a 50 per cent dense nickel-chromium layer brought satisfactory ballistic impact resistance. Erosion was fair. All panels, however, failed under severe thermal shock. Attempts at electrokinetic impregnation of graphite to produce oxidation-resistant coatings showed the process to offer no advantages for highly conductive materials. However, the build-up of surface deposits indicated that electrophoresis would provide an excellent method of coating graphite.

Research and Development on Electrodeposition of New Chromium and Chromium-Alloy Plate by L. D. McGraw and others, Battelle Memorial Institute for Bureau of Aeronautics, U. S. Navy. December 1952. 82 pages. $2.25. Order direct PB 111911 from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

A number of developments in high-efficiency chromium and chromium-alloy plating processes are described in this final report. One was a chromium-iron alloy plating bath which produces hard, bright chromium-iron plate with abrasion resistance and a crack system very similar to conventional chromium plate. Another was an improvement in the process for plating mat-type chromium-iron alloys. Corrosion protection was exceptionally good, and the plates were essentially crack free. They resisted softening at higher temperatures than conventional chromium plate, and consequently were harder than the conventional alloy after annealing at 600C. The only deterrent to commercial use of both the corrosion-preventative and abrasion-resistant baths was a problem of adhesion of the alloy plate to steel, although the degree of adhesion consistently achieved was thought to be sufficient for many applications. The report describes work on plating bath improvement, operating conditions, properties of chromium-iron alloy plates, deposition of alloys other than chromium-iron, and fundamental studies of the operation of the trivalent bath.

Design Properties in High-Strength Steels in the Presence of Stress Concentrations and Hydrogen Embrittlement: Part 3—The Response of High-Strength Steels in the Range of 180,000–300,000 psi to Hydrogen Embrittlement from Cadmium Electroplating by E. P. Klier, B. B. Muvdi, and G. Sachs, Syracuse University for Wright Air Development Center, U. S. Air Force. March 1957. 129 pages. $3.25. Order PB 131034 direct from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Embrittlement of high strength steel from the action of hydrogen introduced by cadmium electroplating was studied in sustained-load, rotating beam fatigue, and bending tests. Among the observations, it was found that all steels are embrittled in some measure after cadmium plating. Baking treatments remove some of the embrittlement, an improvement promoted by redistribution rather than elimination of hydrogen from the steel. The observation that failure promoted by plating is affected by experimental conditions is discussed at length. Cracking in the hydrogen bearing zone seemed dependent, in part, on composition and is minimized by reduction in carbon or increase in silicon.

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Ed Kubis, secretary-treasurer, read the names of 23 applications for membership to our branch, and they were unanimously accepted.

Doug Thomas, educational chairman, introduced the technical chairman of the evening, **Don Bigge,** managing engineer, Engineering Laboratory at Chrysler Corporation. Don introduced the speaker, **Walter L. Pinner,** Houdaille-Hershey Industries, Detroit, with one of the most enlightening introductions heard in a long time. Don, a personal friend of Walter, introduced him by slides, capturing some interesting sidelights of one of the many sojourns made to Curry Beach, Florida, by the members of Committee B-8.

Mr. Pinner, chairman of Committee B-8, presented his report of ASTM Activities on Performance of Plated Coatings. He broke down the 5 sub-committee groups of B-8 and told of present activities of each subcommittee.

A number of slides were shown, showing various types of Cu, Ni, and Ni, Cr, panels plated and the various rates of corrosion indicated as exposed at Curry Beach, Florida; Pittsburgh, Pa., and Detroit. These results were published in PLATING recently.

The various panels exposed were plated by different sources in the same manner, and interestingly so, there was quite a variation in corrosion results among the platers submitted samples. This confusion made it very difficult for the committee to determine accurate results. However, the following conclusions definitely resulted.

1) Watts type nickel appears to be superior to bright nickels as far as corrosion goes.
2) The thickness of chrome plating is very important. The heavier the chrome, the better corrosion results are obtained.

Program No. 6 will study the disrupting in the nickel plate in operation, and this will be thoroughly investigated.

Walter Pinner concluded with a challenge to the plating industry to "find a chrome plate that can be plated heavily that will not dull".

After a very interesting presentation, a lively question and answer period followed.

It was mentioned that the AES Executive Board had agreed that the Educational Program of the 1959 convention would be "The 5th International Conference on Electrodeposition and Metal Finishing Sponsored by the Golden Jubilee of AES."

Robert J. Amis
Publicity Chairman

DETROIT BRANCH ANNUAL MEETING

On December 6, 1957, the Detroit Branch of the American Electroplaters' Society will hold its annual meeting, National Officers Night, in the Statler Hotel, Detroit, Mich., at 8:00 p. m.

The Technical Chairman will be Francis T. Eddy, Technicraft Laboratories, Inc., of Thomaston, Connecticut and National President of the American Electroplaters' Society. He will introduce the speaker of the evening, Dr. W. A. Wesley, International Nickel Company, Bayonne, New Jersey, Third Vice President of the AES. Dr. Wesley's subject will be "Nickel Chromium versus the Atmosphere." This will be a discussion of the effects of a chromium layer on the corrosion behavior of nickel deposits and the variation of corrosion patterns with exposure to different atmospheres.

The Executive Board of the American Electroplaters' Society will be in attendance.

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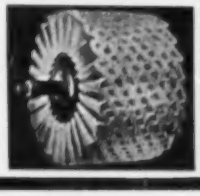

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HARTFORD

Printed Circuitry Presented

The regular Branch meeting was held at the Hotel Bond on Oct. 21, and 63 members and guests were present. Preceding the meeting a movie in color was shown entitled "The World that Nature Forgot" filmed by the Monsanto Chemical Co.

The guest speaker for the evening was **Richard Zems** of Printed Electronics Corp. whose subject was "Selective Plating-Printed Circuitry".

Instead of using wires, the wiring pattern is plated on a non-conducting base which avoids mistakes in the wiring, saves space and also saves soldering time. There are several ways of doing this: A silk screen pattern from a photograph is placed on a copper laminated plastic (various types used depending on the application), this is then plated with solder on the circuit, ink is stripped away, copper is then etched away with acids which do not attack the solder leaving the circuit on the plastic. The silk screen circuit may be painted on with silver conducting paints then copper plated or the copper plated on by reduction on to the plastic, then copper plated and chromic acid etched. These circuits are used in television and radio chassis and also in machine switches. Copper and solder thicknesses deposited are 0.0006 to .001 in. and a film of gold—or for continuous use nickel and rhodium—is used for the contact points.

The technical chairman for the evening was **Ralph McCahan.**

Stanley Platoz
Secretary

INDIANAPOLIS

Interim Meeting Plans Formulated

A special meeting of the Indianapolis Board of Managers was held on Sept. 30, in the F. B. Stevens office. The following attended: **Bert Hawhee, Roman Bender, Marshal Whitehurst, John Hood, Addison Howard, Ed Bruck, John Holland, Loren Stevens, Quentin Shockley** and **Paul Freeman.**

Bert Hawhee read the letter received from **John P. Nichols,** dated Sept. 24, congratulating our branch for having been selected to act as host for the coming 5th Interim Meeting of the Society.

The Executive Board will meet Friday, January 10, 1958; at 9 a. m. Friday evening will be the joint meeting of the Indianapolis Branch with all of the Delegates and/or Alternates attending the Interim Meeting.

Saturday, Jan. 11, starting at 10 a. m. the regular business sessions takes place, ending with a cocktail party in the evening.

The first item of the board concerned the selection of the hotel. Since the Indianapolis Branch meeting would be changed to Friday, we would need ample parking space as well as other considerations.

Roman Bender made a motion that the Branch select the Marott Hotel as the meeting place for the coming Interim Meeting. The motion was seconded by Marshal Whitehurst and carried.

The following committee chairmen were appointed by Bert Hawhee: General Chairman, Marshal Whitehurst; Registration, Ed Bruck; Housing and Reservations, **Les Reynolds;** Luncheons and Dinners, Quentin Shockley; Cocktail Party, Roman Bender; Equipment and Notices, **Elmer Lundberg;** Finance Committee, **John Holland.**

The Board has considered and approved the candidates to be suggested to the Scientific Achievement Award Committee. These candidates from Indianapolis Branch are **Dr. Abraham Max** and **Thomas Evans.**

Paul Freeman
Secretary

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INDIANAPOLIS
Wysong Urges Best Ever Interim Meeting

The Columbus members of the Indianapolis Branch AES were hosts for the Oct. 2 meeting. Fifty-seven attended with their leading ladies at Arvin's Central Park Cafeteria in Columbus, Indiana to enjoy a delicious steak dinner.

Bert Hawbee led the introductions. He then introduced **Ralph (Duke) Wysong** who was our special guest for the evening.

Mr. Wysong first challenged the Indianapolis Branch to make the coming Interim Meeting in January truly a greater meeting than any previous. Then he reminded us that the membership drive should not be neglected but strengthened due to the January Meeting.

Dr. Max has eight signed up for electroplating class but needs 16 before Purdue Extension will sponsor the class.

John Holland then announced the main attraction of the evening which was escorted tours through the Hamilton Mfg. Co. plant.

The motor caravan found their way over to a large parking lot alongside the plant. The Hamilton Mfg. Co. makes the Casco line of household metal furniture, and office equipment chairs. The night shift represented more than half of the normal working plant capacity. The plant buildings cover 12 acres, which are under one roof. Material is received on one side, flows through the processing and is packed and shipped out at the opposite side where there is a railroad siding for 13 box cars, inside the plant. The surprising part is that this company is only about eleven years old. Electroplaters did get to see automatic platers and the very latest painting equipment, too.

Paul Freeman
Secretary

LOUISVILLE
Annual Ladies Night

The annual Ladies Night meeting of the Louisville Branch was held Thursday, Oct. 17, at Hasenbour's Dining and Cocktail Lounge, Louisville. Thirteen couples and four stags were present. Corsages were provided for the ladies by the Branch.

Because this was a special occasion, the regular business meeting was dispensed with and Librarian **Kenneth C. Reifsteck,** introduced the speaker for the evening, **Charles Dibowski.** Mr. Dibowski is the Chief Probation Officer of the Juvenile Court of Jefferson County, Kentucky. His subject was "Problems of Today's Children." His talk, a most interesting one, dealt with juvenile delinquency in this country, the organization and operation of our Juvenile Court, and a discussion of several case histories.

A question and answer period followed, and Mr. Dibowski was heartily thanked for his stimulating talk. Refreshments were served by the Belke Mfg. Co. through the courtesy of **Stanley J. Beyer.**

Frank E. Wilcher
Secretary-Treasurer

MILWAUKEE
Sobczynski and Weiss Fill Vacancies

The 482nd meeting of the Milwaukee Branch was called to order by President **E. H. McCoy,** Oct. 4, at the Maryland Hotel. Three new men were elected to membership and one was transferred from the Detroit Branch. Three applications for membership were presented to the board of managers for action.

Election for vacancies to the office of 2nd vice president and two-year term of a member of the board of managers was held. Nominations presented by the nominating committee were: **Ted Sobczynski** for the former post and **Ed Weiss** for the board of managers. Both were unanimously elected.

Fred Anderson was appointed chairman of the Annual Meeting.

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Les Diveley spoke about the amendment to the National Bylaws regarding the identification and certification of Branch Delegates. Mr. Diveley moved that a committee be appointed to study methods by which the Milwaukee Branch could conform to provisions now requiring delegates to be elected and installed in September. Suggested amendments to Branch Bylaws are to be published in the Newsleaf and voted upon at the following regular business meeting.

The following were appointed to a Bylaws Committee: Les Diveley, chairman, **Phil Ritzenthaler, Frank Marshall, Herman Tessman.**

It was announced that Herman Tessman received an appointment to the National Public Relations Committee.

The meeting was turned over to **Gene Piellusch,** program director, who introduced the speakers for the evening.

Alan R. Burman, vice president of Cro-Plate Co., addressed the Inorganic Section on "Abrasive Blasting As a Metal Finishing Method." The Organic Section heard **Dr. John Jenkins,** first vice president, American Chemical Society, on "Resins and Their End Uses."

S. R. Taterzynski
Secretary-Treasurer

MISSISSIPPI

Blount Speaks on Painting Methods

The Mississippi Valley Branch held their September meeting the 18th at the American Legion in Moline, Illinois. Sixty members and guests were present for the dinner and meeting.

The meeting was called to order by President **Nordblom.** Two new members were elected. A report on Ladies Nite was given by Art Jackson. The date will be November 2, and the place: Moline Legion. It will be a dinner-dance.

Barney Nordblom called upon **Lloyd Gilbert** who gave a short talk about the new Organic Division. He emphasized why it was organized and pointed out some of the benefits it will have for the members.

A report on the Educational Session to be held in April was made by **Stan Nielsen.** It is planned to arrange for three speakers. More definite plans will be announced later.

Stan Baker, librarian, reported on the speakers for future meetings. He then introduced the guest speaker for the evening, **Ezra Blount,** editor of "Products Finishing" magazine.

Mr. Blount began by giving some information and facts about the National Conventions, especially the 1958 convention to be held in Cincinnati. Mr. Blount showed slides and explained the various types of paint application such as standard spray, steam dry, cone and disc rotary, barrel, automatic line dip, and also gave a general talk on the Ransburg method. This was followed by an open discussion.

John L. Hartman
Secretary-Treasurer

MONTREAL

Wiffin Presents Barrel Finishing

In the absence of President **P. M. Coady** the meeting was opened by **J. T. Reisenburg Sr.** with 26 members present.

Mr. Reisenburg called on Librarian **J. Rennie** to introduce the speaker of the evening, **Roy Wiffin** of Norton Co. of Canada.

Mr. Wiffin gave an interesting talk on "Barrel Finishing" complete with color slides. He answered questions and was thanked on behalf of the members by **J. Saimoto.**

Seven membership applications were read and approved.

W. T. Scott
Secretary-Treasurer

NEWARK

Dalic Method Explained by Rubenstein

The president called the meeting to order with about fifty members present.

Three applications were accepted for action and five men were elected to membership. **Gus Bittrich** reported on the Annual Banquet and asked the members to state their feeling regarding organic finishing on evaluation slips distributed to all present. **Don Foulke** introduced visitors

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Franklyn MacStoker, Past AES President, **Milt Nadel**, Secretary of the New York Branch, and PLATING editor **Rodney Leeds**. Milt Nadel announced the New York Branch Annual Technical Session and Banquet to be held on Feb. 1, 1958, and invited Newark members to attend. Newark Branch members introduced as luminaries in the metal finishing field were **John P. Nichols**, AES Executive Secretary, **Andy Wesley**, AES Third Vice President, **Pete Kovatis**, NAMF Secretary, and **Bob Ehrhardt**, chairman of the AES Research Committee.

Librarian **Fred Meyer** then presented **Marvin Rubenstein** and **Jesse Lane** of Marlane Development Co. Mr. Rubenstein first described the Dalic Method noting three differences from old brush plating techniques as improved solutions, special brushes (styles) and broadened engineering applications. He showed a number of slides explaining the Dalic Process, the styles used, baths and properties of deposits. Mr. Lane then demonstrated how the process worked, plating a number of samples of all types including steel, aluminum, etc., using a rectifier and equipment brought to the meeting room for this purpose. A spirited question and answer period attested to the interest in this specialized, engineering method of plating.

D. Gardner Foulke
Secretary

NEWARK BRANCH ANNUAL MEETING and CHRISTMAS PARTY

The forty-fourth annual educational meeting and Christmas party of the Newark Branch, AES will be held at the Hotel Robert Treat, Newark, N. J., December 13 and 14.

Two technical subjects will be presented at the educational session on Friday evening, the 13th. H. Koretzsky of Hanson-Van Winkle-Munning Co. will discuss "Waste Disposal Problems." The "Effects of Impurities in Cyanide Plating Solutions" is the title of the paper to be presented by R. E. Goodman, New York District office of E. I. duPont de Nemours & Co.

Members, their ladies and guests attending the Christmas Party on Saturday evening, December 14 are assured of cocktails, banquet, entertainment and dancing in the enjoyable tradition for which Newark Branch is so well known.

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Write American Electroplaters' Society, Inc., American Building, 445 Broad Street, Newark 2, N. J. Payment should accompany order to obviate unnecessary bookkeeping expense.

PHILADELPHIA

Annual Educational Session and Banquet

The Annual Educational Session and Banquet of the Philadelphia Branch was held on Nov. 2 at Philadelphia's newest hotel, the luxurious Sheraton. The Educational Session was held in the afternoon, with **Dr. Samuel Heiman**, AES Past President, as chairman and about 40 attending. Guests introduced were: AES President **Francis T. Eddy**, AES Third Vice President **Dr. W. Andrew Wesley**; AES Executive Secretary **John P. Nichols**; **Rodney Leeds**, editor of PLATING, **P. Peter Kovatis**, executive secretary NAMF and **A. Marianno**, secretary, New York Branch NAMF.

The initial speaker was **Dr. George P. Swift**, consultant, AES Past President and secretary, Boston Branch, whose topic was "Metallurgy and its Relationship to Plating." Starting with the evolution of steel development from the relatively simple manufacturing methods in small batches of the 19th Century to the large batches of complicated mixes today, Dr. Swift told of the parallel changes in plating solutions and procedures required to cope with the changes in steel.

A similar situation has been caused by method-of-manufacturing changes in brass. The addition of lead to brass to lower cost and provide free machining produced plating adhesion difficulties, the overcoming of which has been accomplished by the use of an acetic acid dip, prior to copper strike and subsequent plating.

The introduction of stronger zinc die castings also presented a new plating adhesion problem, for which a solution was found by the use of strong alkaline cleaners, as used in steel. The use of lead, tin and cadmium in scrap added for secondary melting produced such adverse adhesion results, that this led to the adoption of the specification of 0.01 per cent total lead, tin and cadmium permissible in die castings to be plated.

With aluminum, it was found that silicon gave high strength aluminum alloys; however, with complications of the plating procedure. It was overcome by the use of hydrofluoric acid or fluoride salts to remove the silicon prior to plating.

The addition of silicon and aluminum to bronze to provide a stronger product, brought adhesion problems that were overcome only with the use of specially formulated acid solutions.

Carbon monoxide added to give an increased ingot yield and improved rolling qualities, gave a porous surface that was found to trap plating solutions.

Automobile engines brought in the problem of chromium plating cast iron liners and it was found that a cadmium flash prior to chromium helped. In effect, this procedure was a cleaning agent that deposited a very thin metallic coating.

The electronic industry has presented the problem of plating on metal prior to fabrication. The use of brush plating helped overcome scratches and dents in expensive assemblies.

Summing up, Dr. Swift stated that new developments in metallurgy always lead to changes in plating and finishing procedures.

The second speaker was **Mariano Ranno,** Imperial Plating Co., Brooklyn, N. Y., whose topic was "The National Association of Metal Finishers and Plating." Organized three years ago, the first committee to be formed by the NAMF was the Nickel Committee. It brought before Congress he said, the inequitable distribution of nickel that had worked such hardship on platers. This, he said, resulted in Congressional Committee investigation that reportedly produced relief in the nickel situation for the platers.

The pricing of plating in job shops next received attention. A summary of the plating cost data showing the difference in plating costs between 1955 and 1957, an increase of about 25 per cent, was distributed to the audience and was discussed by Mr. Ranno.

The NAMF, he continued, is working on a code of ethics and industry standards. The original Nickel Committee has been replaced by a Metal Committee that is ready to go to work immediately on a critical situation in any metal, such as was done with nickel.

He read a letter sent by John Palik Jr., NAMF president, to Senator Humphrey, which was read into the Congressional Record.

The final speaker was **Dr. D. Gardner Foulke,** manager, Electrochemical Development, Hanson-Van Winkle-Munning Co., and secretary, Newark Branch, AES. His topic was "Current Aspects of Waste Disposal."

There is no preponderance of any one treatment method at the present time. The many papers presented and the publicity given waste treatment and disposal has lead to a better understanding by platers of the problems involved. Waste treatment and disposal is linked closely to the much larger question of water conservation. Dr. Foulke cited the forecast given of water usage in 1980—480 billion as against 1955 consumption of 250 billion gallons daily. This has made the economic use of water a matter of prime consideration.

Important are the proper segregation and treatment of wastes, proper engineering to minimize waste treatment quantities and good housekeeping to maintain the advantages of good engineering. Dr. Foulke showed slides illustrating proper drainage of racks, draining of plating barrels into empty tanks before rinsing after plating and the recovery of zinc plating solution in a barrel plating installation.

Photograph courtesy of Plating Management.

Participants in Philadelphia's Annual Educational Session, left to right, Dr. George P. Swift, Mariano Ranno, Branch President Robert L. Fanen Jr., Dr. D. Gardner Foulke, Dr. Samuel Heiman, session chairman.

In discussing the type of waste treatment system to be operated, the final decision as to the use of a destruction or recovery type system was dependent on the dictates of economy. As water becomes more expensive, the recovery type will be favored.

Then followed a question period in which all speakers took part. During this period, Dr. Wesley made the announcement that at a meeting the week previous he learned by February 1, 1958, the nickel situation will have so eased there will be more than enough of this metal for platers.

The evening's activities got underway with the banquet, distribution of door prizes, show and dancing until 1 a. m. in the main ball room, attended by 350.

I. Wm. Marcovitch
Secretary

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Heavy gauge steel with wire woven through steel angle firmly attached to main stem. Cannot come apart or loosen. Side clip is for STUTZ BARREL PLATING TANKS having submerged rectangular anode bars. Side clip not furnished for racked plating tanks. Standard hook 6 inches. Other hook lengths furnished in quantity of 100 or more.

Welded Construction

Note how welds have dissolved or broken in use. Often caused in barrel plating where currents are high and barrel transfer is rapid.

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PORTLAND

Saltonstall Addresses West Coast Branch

Our fall season got under way with a very lively and interesting meeting held at the Old Country Kitchen on Sept. 16. Thirty members were present and enjoyed a delicious steak dinner. Our fall program was outlined and through the cooperation of other coast Branches, the members are looking forward to some very interesting speakers. It was heartening to see that five potential new members were in attendance and it looks like the '57-'58 year should be a good one for Portland.

Our guest speaker for the evening was **Dr. R. B. Saltonstall** of the Udylite Corporation, who gave an interesting and informative talk on Nickel Plating and told Portland Branch what was new in nickel plating and some of the things they can look for in the future. Immediately following his talk, Dr. Saltonstall opened a question and answer period and a lively discussion followed. All the members certainly feel a debt of gratitude for such a fine speaker traveling to the coast to talk to us.

Dale Tweed
Secretary-Treasurer

SAGINAW VALLEY

Corrosion Topic of Paper Given by Fellows

The Saginaw Valley Branch held their regular meeting at Zehenders Hotel in Frankenmuth, Michigan on Oct. 9. Members and guests from Dow Chemical, General Motors Research Staff, Metal and Thermit, and Oldsmobile enjoyed a ham dinner.

"Mechanism of Corrosion of Plated Coatings" with particular emphasis on chromium plate was the lecture topic of the evening. **Richard Fellows,** of Udylite Research, gave the talk from a paper prepared by Dr. Henry Brown.

Chromium, plated from a conventional bath of 100-1 ratio, at room temperature, and having ten to twenty millionths thickness, is porous and develops cracks on aging. Corrosion cells form, leading to plate failure. By increasing ratios to 135-1, temperature to 130F, and thickness to thirty millionths and over, a less porous and crack-free chromium plate was obtained. Fuming nitric acid, salt spray, and roof exposure verify this. **Don Millage** assisted Mr. Fellows with the slides.

Leo Mangett won the door prize donated by **Charles Auger** of the Metalwash Corp. **Art Medwedeff** showed two films on our state of Michigan to conclude the activities.

P. A. Waskevich
Recording Secretary

SAINT LOUIS

Delegates/Alternates Elected; Branch Explores Convention Possibility

The first fall meeting was held Wednesday, Oct. 9 at the York Hotel with 24 members and guests present for dinner. The meeting was called to order by President **Craig McAlister** with 30 members and guests present. Each person stood and introduced himself and gave the company with which he is connected.

Three new members were accepted into the branch by unanimous vote.

The Delegates for the coming year were elected: **A. P. Julius, R. E. Coulson,** Craig McAlister. The Alternates are: **Henry Siegel, Louis Berra, Charles McGinley.**

In the absence of **Ed Sertl,** chairman of the educational committee, **Louis Berra** reported the plating class was two weeks old and could accept a few more students since the first two weeks were spent primarily in reviewing the last year's work.

Andy Julius related how our delegates made a bid for the national convention for 1963. The following committee was appointed to study the possibility of having the convention here that year. Craig McAlister, Louis Berra, Robert Coulson and Andy Julius. They are to have a report next meeting.

Our librarian introduced the speaker of the evening, **Jack Winter** of Incar Inc., Cleveland, Ohio, who made an interesting talk on "The Anode Side of the Story." His talk was accompanied by slides which depicted many faults and showed corrective measures which could be taken.

Ward Kelly
Secretary

SOUTHEASTERN BRANCH

Irwin on Acid Cleaning

The Southeastern Branch held its regular meeting Oct. 11, 1957 at the Belmont Steak House. **J. T. Irwin,** Promat Division, Poor and Company spoke on "Acid Cleaning of Steel" covering the preparation of steel for various coating procedures and the use of inhibitors and depolarizers in muriatic and sulfuric acid cleaning. Guests from Atlantic Steel Company were **E. C. Kinney** and **Nathan Howard.** Delegates were appointed as follows: **George W. Taylor, H. R. Stogner, Sr.,** and **Robert H. Probert.** Alternates appointed were **William Weymouth, Edward T. Logan,** and **Clem Hohner.**

Robert H. Probert
Secretary-Treasurer

SOUTHERN TIER

Planning Christmas Party; Pike Speaks on Buffing

Regular monthly meeting held Oct. 15 at the Au-Wa-gn Hotel, Oswego, N. Y. Approximately 22 members and guests enjoyed a fine dinner and interesting meeting. President **S. Stefanski** introduced new members and guests. President Stefanski appointed a committee to take of arrangements for the annual Christmas Party. Those helping on this committee will be S. Stefanski, **C. Emery, M. Rake, B. Wells, C. Bound, B. Rossiter.**

It was suggested that action be taken to make up membership badges and guest cards to be used at all the meetings.

Librarian C. Emery, introduced the guest speaker, **Walter Pike** from Hanson-Van Winkle-Munning Co. Mr. Pike's topic for the evening was "Polishing and Buffing," with emphasis on aluminum. In his discussion he mentioned the 2 stages of buffing; 1st being the cutting stage, removal of the polish lines accomplished by using form of Tripoli compound. Second, the coloring stage which simulates burnishing. For coloring he recommended calcine aluminae (white rose) among several other materials. He mentioned that double-duty compounds are now being used but for finer operations the two stages of cutting and buffing are better.

Advantages of using liquid buffing compounds are: eliminate down time, control amount of material, longer buff life, less wasteful—disadvantages: would be limited amount of cut, depth of color. A question and answer period followed the talk.

B. Rossiter

SPRINGFIELD

Rectifiers Discussed by Schneiders

The Springfield Branch met at Blake's Restaurant, on Monday evening, for the regular monthly Business Meeting and Technical Session. After a tasty steak dinner, a short business meeting was called by President **Charles F. Griffin Jr.** to choose Delegates and Alternates to the Cincinnati Convention next May.

The following were named: Delegates—**Harold L. Mitchell, Edward F. Koetsch Jr.** and **Elery C. Gibson;** Alternates are—**Robert J. Girard, Charles F. Griffin Jr.** and **Ernest E. Couture.**

For the Technical Session, those present enjoyed a very enlightening explanation and discussion on "Rectifiers—and How They Work", by **Frank Schneiders,** service engineer, Enthone, Inc. of New Haven, Conn. Frank had a mock-up unit with individually controlled manually operated switches, which were tied in with an oscilloscope, to visually portray actual results obtained with electric power. There was a great deal of interest, and many questions when the discussion period ended. Thank you, Frank!

Henry L. Heissfeld
Secretary

TOLEDO

Saltonstall Speaks; To Hold Joint Meeting With Central Michigan

The first monthly meeting of 1957-1958 fiscal year of the Toledo Branch was held Oct. 3, at Angelo's Spaghetti House.

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SHELL

Twenty-nine members (60 per cent of membership) and five guests were present. After the new Delegates were elected, **Ben Gomersall,** secretary, gave a report on the Montreal Convention. He stressed the need of the Toledo Branch supporting the increased per capita tax proposal. The Board of Managers were instructed to study the Branch dues and make the necessary recommendations to strengthen our financial status. The members voted to have a joint meeting and plant trip with the Central Michigan Branch in February. **Albert Symanowski** and **Walter Morrow** were appointed on the transportation committee for this event.

Dr. Richard B. Saltonstall, technical director of the Udylite Corporation, spoke on the timely subject "Correction Value of Chromium Coatings". He told of their research findings where heavier chromium deposits showed better corrosion values in the accelerated and outside exposure tests. These deposits came from a chromium bath where the sulfate radical was lower in ratio to the chromic acid than in the present conventional bath. Also, the bath temperature was higher.

I am sure many of the platers went back to their shops and became research chemists the next day.

Ben Gomersall
Secretary

TORONTO
Underhill is Speaker; Award to Plating Student

The second meeting of the AES Branch fall season got underway in Toronto, Oct. 11, Thanksgiving weekend. With the flu epidemic in full effect, only 19 sat down to dinner but 30 turned out for the meeting.

Our President, **Mel Green,** was out of town and this gave the vice president a chance to wield the gavel—and a good job was done by **Ray Day.** One of his chores was to terminate the dinner draw. What effect this will have on attendance is yet to be determined but the executives are hoping for the best.

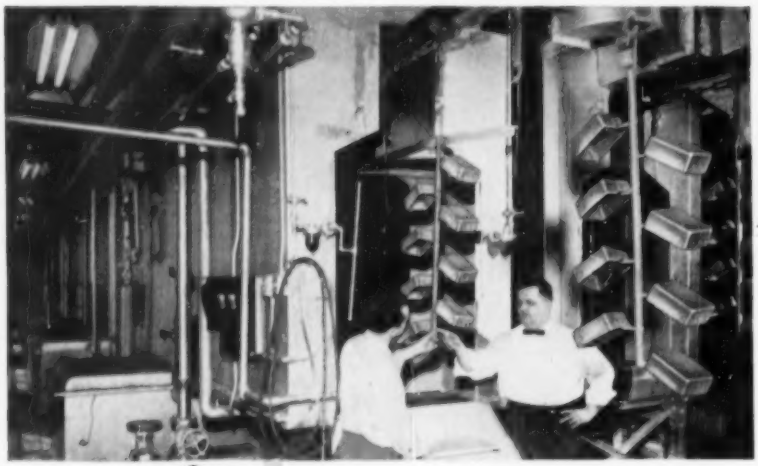
The Delegate for the Convention was elected and Yours Truly got the honors.

An award of $25 to the leading student 1957-58, Electroplating Night Class at Central Technical School was passed unanimously.

The annual dance is to be held November 29 at the Club Kingsway.

The evening was rounded out by one of our own members, **Howard B. Underhill,** marketing manager, Coated Abrasives Division, 3M Canada, giving us a very interesting talk on "Abrasive Belts and Wheels," also a 30-minute color movie—"A Challenge to Steel." A hearty vote of thanks was extended to Bud.

A. W. Wilson
Librarian



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WATERBURY
Plan Employment Committee; Membership Drive Outlined

The October Business Meeting of the Waterbury Branch was held Thursday evening, Oct. 3, at the home of Secretary **Albert Griffith,** Cheshire, Conn. President **Spencer Henn** opened the meeting which was well attended.

A few of the ramifications involved in the changing of the fiscal year to end June 30 for the National Society and later for all of the Branches were discussed. National President Frank Eddy outlined some of the steps taken to date.

President Henn named the members of the Waterbury Branch Bylaws Committee: **T. Voyda,** chairman, with **W. C. Giesker** and **E. B. Washburn** assisting. This Committee was instructed to draft a set of Bylaws to be presented at a future business meeting for comment, constructive criticism, revisions and additions.

The Branch Delegates to the 1958 New England Regional Committee Meetings were named. A. G. Griffith, **F. Tirendi,** and **I. Cross.** The responsibility of the Waterbury Branch at the 1958 Regional Convention will be to present the Educational Program. A Committee Meeting was scheduled for Wednesday, Oct. 9 at 8 p. m. at the Statler in Hartford. The shortcomings and successes of the 1957 Regional will be discussed and suggestions will be made for the 1958 Regional.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1273.

Ray Mitchell, Sustaining Membership Chairman, announced the loss of one member, Mattatuck Mfg. Co., and one new member, The Apothecaries Hall Co. Division of the Hubbard Hall Chemical Co. It was suggested that all copies of our Monthly Meeting Notices and Newsletters be mailed to our Sustaining Members. February 13, 1958 was set for our Sustaining Members' Night and the Chairman was instructed to start publicizing this date. **I. Cross** volunteered to work with **Ray Mitchell** in planning the program for the evening.

Lou Poretti was named chairman of the Committee for our Christmas Party. Assisting him will be **Frank Schneiders** and **Michael Orient.** They were instructed to start immediately on this affair and to plan and organize a really good party.

Ed Garland, chairman of our Membership Drive, briefly outlined his campaign plans and asked for suggestions. Ray Mitchell and Ed Washburn mentioned plans used by other branches, to bring in new members as guests at regular monthly educational meetings. A few names of prospective members were given to the chairman.

Frank Schneiders briefly outlined a plan for the formation of an Employment Committee which would try to keep informed of members who are seeking a change in employment, and also to have the managements of local companies contact this Committee whenever they are looking for trained personnel. Frank Schneiders volunteered to act as chairman of this Committee. He was instructed to pick a Committee and formulate plans to be presented at our next Business Meeting. Publicity for this Committee will be given in our monthly Newsletter.

It was also suggested that the Branch and/or the Newsletter act as a clearing house for wanted or available finishing equipment. The secretary volunteered to arrange for the advertisements in the monthly Newsletters whenever such information is given to President Henn—**N. Topazio** or the Secretary. Mr. Griffith served refreshments.

The regular monthly meeting was held Oct. 10 at the Hotel Roger Smith. The dinner was held at 6:30 p. m. and the educational program started at 8 p. m. The meeting was opened by President Spencer Henn. He gave a brief review of our business meeting and then turned over the meeting to the Technical Chairman, **Perry Sloane.** The Movie "Bethlehem Steel" was shown and was very interesting.

Mr. Sloane then introduced the speaker, **Frank Schneiders,** sales engineer for the Enthone, Inc. His subject was, "Rectifiers —The Inside Story." He demonstrated and described each functional part of a rectifier and showed the effect of these parts on the current on the oscilloscope. He also had samples of various commercial rectifiers.

Three new members were elected.

Nicholas Topazio
Publicity Director

WESTERN ONTARIO

Industrial Waste Heard; Ladies Night Planned

The Western Ontario Branch of the Society held its October meeting at the William Pitt Hotel, Chatham, Ontario, on Friday, Oct. 18. There were 23 members and guests.

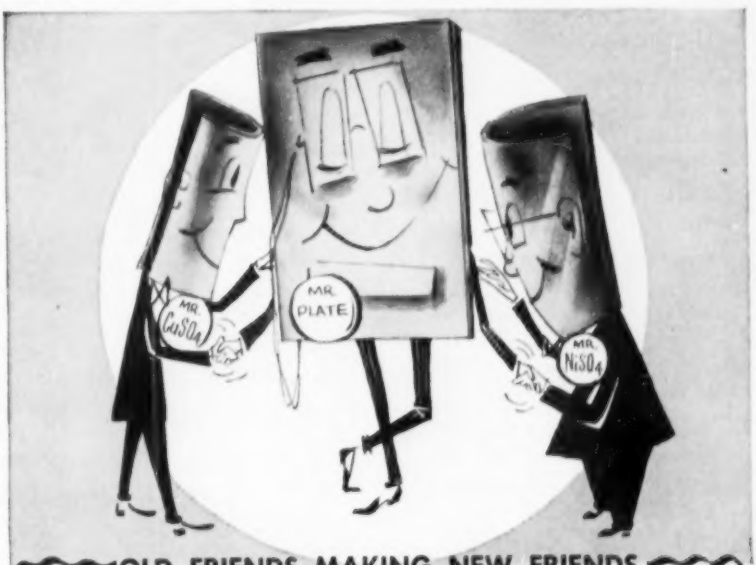
Paul Croly was presented with a Past President's pin. **Les Crooks** performed the honors, correcting a long standing oversight. Paul, one of our stalwart senior members, served in 1951.

The subject for the evening was "Industrial Waste in Ontario Water System". The speaker was Fred A. Voeghe, Supervisor of Ontario Water Resource Commission, Toronto, Ontario. He placed squarely before the membership the objectives of the Commission and this branch now knows the problems ahead of them on waste disposal.

Dave Mainland was appointed chairman for the Ladies Night to be held at the William Pitt Hotel, Chatham, Ontario, on Jan. 17.

The turnout was not as good as expected; maybe the Asiatic flu had something to do with that.

Earl L. Patterson
President



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AES Membership Report

ELECTIONS

Allentown-Reading: R. E. Reichard

Bridgeport: J. R. Jones

Central Michigan: W. E. Hamaker

Chicago: D. R. Arendt, L. L. Brown, A. A. Comyn, J. A. Fritz, F. P. Green, E. R. Kopciuski, J. Kopciuski, J. Nemec, J. S. Parker, M. M. Rhodes, F. L. Salay, R. Schaetzlein, W. Yeoman

Cincinnati: C. Allison, L. Edwards

Columbus: R. A. Benson, W. R. Brown, J. L. Cochran

Detroit: H. Allstendt, A. J. Bacha Jr., R. K. Barnett, N. Bartholomew, G. R. Booth, C. T. Campbell, M. F. Cole, C. J. Conte, E. H. Drew, R. S. Firlik, J. C. George, C. A. German, H. A. Goldsmith, J. J. Gondek, E. A. Kawas, C. L. Kuhl, R. C. Miller, S. H. Obey, F. D. Patterson, R. W. Rapp Jr., M. H. Teklinski, J. M. Vander Ploeg, L. J. Wicks

Hamilton: H. Dexter, A. Pearson

Hartford: E. L. Andrew, W. G. Brown, R. D. Lindner, A. J. Norton, E. Odishoo, G. R. Poe, N. E. Stevens

Milwaukee: L. Brazier, W. R. Draeger, W. Snyder

Mohawk Valley: M. York

Montreal: J. Domaracki, B. Fortin, G. M. Kerr, L. Lamarre, G. E. McGuire, B. B. Millward, W. G. Walker

Newark: S. Klein, J. W. Miller, C. R. Ott, G. P. Shaw, W. Szekely

New York: E. Cates, J. F. LoTufo, H. Spielvogel, H. B. Swede

Philadelphia: B. E. Burkhardt, W. E. Graul, G. H. Rhodes, A. L. Volk

Rochester: J. J. Paudina

Saginaw Valley: R. W. Harger, E. N. Jarvis, G. N. Novak, J. R. Reed

St. Louis: M. H. Fink, F. A. Kallus, R. E. Smith

Southeastern: J. J. Mullins, J. C. Rowan

Southern Tier: J. F. McCarty

Sydney: A. C. Moremon, H. G. Robins

Toronto: D. M. Brown, C. L. Hodgins, W. H. McKinney, J. B. Stokes, A. M. Stuart, R. G. Verbrugge, R. H. Wright

Waterbury: M. L. Eddy, C. M. Nininger, D. Stango

Member-at-Large: L. A. Fishoff, Morteau, France; Celon Mona, Covington, Virginia

REINSTATEMENTS

Detroit: A. D. Barnett, H. L. Boggus, J. Hipolyt, J. A. Jacks, C. L. Jones, S. J. Omillian, S. Pawlak, C. Schwall, W. A. Sugg, J. W. Taylor, M. Wallace

Melbourne: D. W. Donaldson, F. Latta, A. E. Murphy

New York: A. Kaye

Philadelphia: F. J. Krzos

Toledo: F. B. Barrett, R. G. Volk

Member-at-Large: H. I. Badawi, Gamalia, Egypt; E. F. Ben-Menachem, Tel-Aviv, Israel, S. Wernick, Birmingham, England

TRANSFERS

Baltimore-Washington: T. R. Boggess to Blue Ridge, T. L. Johnson to Blue Ridge

Capitol District: P. D. Callahan to Blue Ridge

Chicago: A. Kaupe from Pittsburgh, A. R. Tefft from New Haven

Cincinnati: W. A. Hopkins from Newark

Detroit: H. E. Sigwell to Milwaukee, S. S. Wilson to Newark

Los Angeles: H. A. Ey Jr. to Member-at-Large

Milwaukee: H. E. Sigwell from Detroit, H. M. Smith from Providence-Attleboro

Montreal: J. E. Martiquet to Toronto

Newark: W. Hopkins to Cincinnati, S. S. Wilson from Detroit

New York: H. Haines to Waterbury

Providence-Attleboro: H. M. Smith to Milwaukee

St. Louis: J. C. Besonette to Dallas-Ft. Worth

Southeastern: J. E. Kennerly to Waterbury, H. R. Welfare to Blue Ridge

Syracuse: N. F. Murphy to Blue Ridge

Toledo: M. A. Park from Detroit

Toronto: N. Gregson to Hamilton, J. E. Martiquet from Montreal, R. S. Oakey from Bridgeport

Waterbury: H. C. Haines from New York

RESIGNATIONS

Chicago: E. J. McCormick

Cincinnati: R. J. Meyer

Hamilton: R. Burke, W. Gregg, E. H. Marsh

Saginaw Valley: M. B. Dabler

St. Louis: H. P. Materne

Sydney: H. Exton, H. Smith

SUSPENSIONS

Adelaide: K. C. Lindner

Allentown-Reading: W. P. Maslo, G. Nissen, A. Santarelli

Bridgeport: M. Aros, R. Rawstron, C. Seiser

Hartford: A. Baron, G. Tetlow

Milwaukee: F. Gutman, G. Malmstrom, L. Manhardt, R. R. Merril

Philadelphia: C. Kramer

Rochester: A. Polvino

St. Louis: P. W. Babby, J. W. Beane, A. Hunning, E. E. Mauer, F. Runzi, P. Sarakas, E. P. Savage, W. Sullivan

Sydney: H. W. Connolly, A. Forbes, E. Larment, P. N. Simpson, K. Sloss, J. E. W. L. Smith, R. H. Townsend

Toronto: W. A. Hogarth, T. Von Reitzenstein

Waterbury: M. Stango

DEATHS

Saginaw Valley: P. Parker

St. Louis: L. Schowalter

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PROVIDENCE-ATTLEBORO

Secretary: William F. Cahill Jr.
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Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES branch members and members-at-large only, in good standing, are entitled to a total of three *free* advertisements in any twelve month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

SITUATION WANTED—Salesman, Industrial detergents, buffing compounds' plating supplies. Experienced in all phases of electroplating, seeks position as sales or service engineer within 150 mile radius of Cincinnati, Ohio. Reply to Box D1, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Graduate Chemical Engineer—eight years experience research development and field technical service in chromium chemicals, metal finishing, corrosion control, and water treatment. Seeks responsible position with opportunity in east coast area. Age 29, married. Reply to Box D2, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Supervisor with 33 years plating experience seeks position, preferably in Wisconsin area. Experience includes 28 years of plating in job shop, 3 years of plating and paint of aircraft, 2 years in automotive plating bonderizing and painting. Will give references. Reply to Box D3, PLATING, 445 Broad St., Newark 2, N. J.

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FUTURE MEETINGS

AES

December 14—**Newark Branch,** Annual Banquet and Christmas Party, Hotel Robert Treat, Newark N. J.

January 10-12, 1958—**Executive Board Meeting,** Hotel Marott, Indianapolis, Ind.

January 11, 1958—**5th Interim Meeting, Supreme Society,** Hotel Marott, Indianapolis, Ind.

January 25, 1958—**Chicago Branch,** 45th Annual Educational Session and Banquet, Conrad Hilton Hotel, Chicago, Ill.

February 1, 1958—**New York Branch,** Annual Educational Session and Banquet, Hotel Statler, New York, N. Y.

February 14-15, 1958—**Southeastern Branch,** 3rd Annual Technical Session, Dinkler-Plaza Hotel, Atlanta, Ga.

May 19-22, 1958—**45th AES Annual Convention,** Sheraton-Gibson Hotel, Cincinnati, Ohio.

June 14-18, 1959—**Golden Jubilee Convention and International Exposition,** AES, Detroit, Mich.

July 10-14, 1960—**47th AES Annual Convention,** Hotel Statler, Los Angeles, Calif.

INTERSOCIETY

January 27-30, 1958—**Plant Management and Engineering Show,** International Amphitheatre, Chicago, Ill.

January 28-31, 1958—**Society of Plastic Engineers, 14th Annual Technical Conference,** Sheraton-Cadillac Hotel, Detroit, Mich.

February 10-14, 1958—**American Society for Testing Materials,** Committee Week, Statler Hotel, St. Louis, Mo.

March 17-21, 1958—**National Association of Corrosion Engineers, 14th Annual Conference,** Civic Auditorium, San Francisco, Calif.

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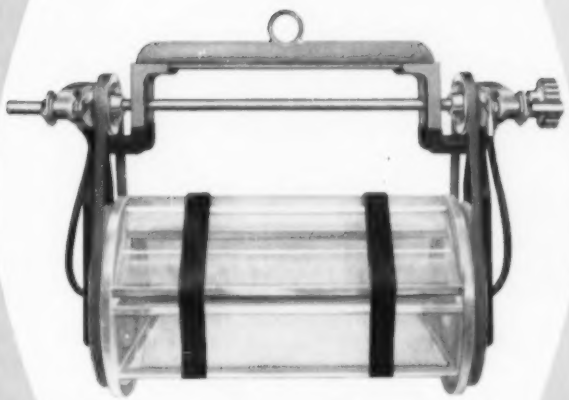

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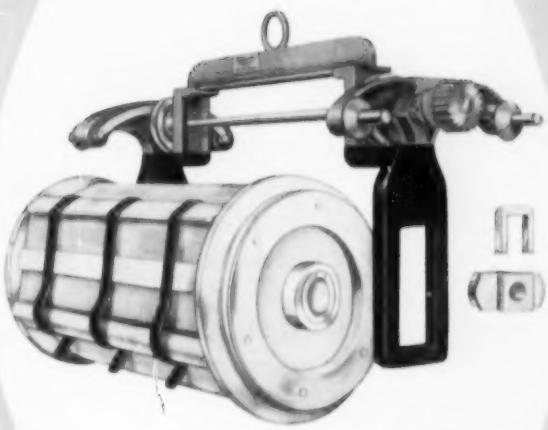

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INDEX TO ADVERTISERS

This index is published as a service to our readers. We regret we cannot assure avoidance of inadvertent errors and omissions despite the many precautions exercised.

A

Allied Research Products ... 1268
Almond Publishing Co. ... 1346
American Agile Corp. ... 1315
American Buff Co. ... 1269
American Metal Co., Ltd. ... 1276
American Platinum Works, The ... 1282
American Rack Co. ... 1335
Apothecaries Hall Co. ... 1278

B

Baker Co., M. E. ... 1326
Beam-Knodel Co. ... 1356
Belke Manufacturing Co. ... 1266
Better Finishes & Coatings, Inc. ... 1369
Bison Corp. ... 1317
Buckingham Products Corp., The ... 1327

C

Carborundum Co., The ... 1271
Chemical Corp., The ... 1337
Cleveland Process Co., The ... 1342
Cohn Mfg. Co., Sigmund ... 1341
Consolidated Electrodynamics ... 1319
Conversion Chemical Corp. ... 1281
Cowles Chemical Co. ... 1352

D

Davies Supply & Mfg. Co. ... 1338
Diesel Chemical Co. ... 1345
Diversey Corp., The ... 1290
Dixon & Rippel, Inc. ... 1344
Duggan Masking Devices ... 1347
Du Pont de Nemours & Co., E. I. Electrochemicals Dept. ... 1274–1275, 1286

E

Euthone, Inc. ... 1259

F

Formax Mfg. Corp. ... 1343
Frank, Paul ... 1345

G

Guaranteed Buff Co., Inc. ... 1344
Gumm Chemical Co., Inc., Frederick ... Second Cover

H

Hanson-Van Winkle-Munning Co. ... Bet 1290–1291
Harshaw Chemical Co., The ... 1262
Hull & Co., Inc., R. O. ... 1284

J

Joe-D-Buff Co., The ... 1335

K

Kocour Co. ... 1317
Kosmos Electro-Finishing Research Inc. ... 1337
Kushner, Joseph B. ... 1338

L

Lasalco, Inc. ... 1283
Lea Mfg. Co., The ... 1322A, Back Cover
Lea Ronal, Inc. ... 1322B
L'Hommedieu & Sons, Charles F. ... 1279

M

Macnar, Inc. ... 1322
MacDermid, Inc. ... Third Cover
Meaker Co., The ... 1323
Merchants Chemical Co., Inc. ... 1277
Metal & Thermit Corp. ... 1287, 1325
Michigan Buff Co. ... 1337
Michigan Chrome & Chemical Co. ... 1267
Mutual Chemical Div., Allied Chemical & Dye Corp. ... 1273

N

National Aluminate Corp. ... 1339
New Jersey Metals Co. ... 1288

O

Oakite Products, Inc. ... 1272

P

Packer Machine Co. ... 1333
Phelps Dodge Refining Corp. ... 1353
Professional Directory ... 1355
Promat Div. of Poor & Co. ... 1356

R

Reynolds Chemical Products Co. ... 1312

S

Schaffner Mfg. Co., Inc. ... 1314, 1316
Seeley Co., Inc., E. E. ... 1335
Sel-Rex Corp., Precious Metals Div. ... 1347
Sel-Rex Corp., Rectifier Div. ... 1289
Sellers Engineering Co. ... 1321
Sethco Manufacturing Co. ... 1343
Seymour Mfg. Co., The ... 1329
Shell Chemical Corp. ... 1351
Spraying Systems Co. ... 1344
Stevens, Inc., Frederic B. ... 1260
Stutz Mfg. Co., George H. ... 1349, 1357
Sulphur Products Co., Inc. ... 1336

T

Tamms Industries, Inc. ... 1346
True Brite Chemical Products Co. ... 1324

U

Udylite Corp. ... 1331
Unit Process Assemblies, Inc. ... 1338
Univertical Foundry & Machine Co. ... 1336

V

Vanton Pump & Equipment Corp. ... 1322

W

Wagner Brothers Inc. ... 1264–1265
Westinghouse Electric Corp. ... 1270
Wyandotte Chemicals Corp. ... 1313

Z

Zialite Corp. ... 1354

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Nonmembers $8.50 Members $7.50

INDEX TO VOL. 44 PLATING 1957

Page

A

Abrasion Resistance Measurement of Coated Surfaces (Art. Ref.) 805
Abrasive Article—No. 2,780,533, February 5, 1957—E. Hurst (Pat. Abs.) 1000
Abrasive Product—No. 2,780,534, February 5, 1957—J. Kuznak and D. Bell (Pat. Abs.) 1001
Acetylene Carboxylic Acid, Production of—No. 2,786,022, March 19, 1957—V. Wolf (Pat. Abs.) 1101
Acidproof Vessel Construction with Membrane and Brick Linings (Art. Ref.) 692
Adhesion of Electrodeposits, Project No. 3; A. L. Ferguson; AES Research 494
AES
Abstracts of AES Convention Papers 520, 644
First Educational Session; C. F. Nixon, Chairman
Leveling in Cyanide Copper Baths—A Further Study—B. D. Ostrow, F. I. Nobel 520, 644
Bright and Semi-Bright Crack-Free Chromium—Dr. E. J. Seyb, A. A. Johnson, A. C. Tulumello 520, 645
Electroplating on Nickel and Nickel Alloys—W. W. Sellers, C. B. Sanborn 520, 645
Corrosion Resistance of Tin Alloy Electrodeposits—F. A. Lowenheim 520, 645
Second Educational Session—W. P. Pinner, Chairman
Effects of Plating on High Tensile Strength Steel—Dr. W. Beck and E. J. Jankowsky 521, 645
Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating—Dr. M. H. Jones, Chih-Yeu Lu, J. Zajdowski 521,646
Analytical Methods for Trace Quantities of Cyanide Compounds in the Plating Room Effluent—W. F. Stevens, L. E. Laney 521, 646
Accelerators and their Function in Phosphating Solutions—L. O. Gilbert 521, 646
Third Educational Session—A. West, Chairman
New Look in Plating Room Power—C. F. Ivins Jr. 521, 646
Latest Developments in Electroplating with Ultrasonics—S. R. Rich 521, 646
Corrosion and Materials of Construction in the Plating Room—T. J. V. Cudbird 521, 646
The Future of Plastics in Electroplating Plant—H. Silman 521, 646
Fourth Educational Session, Dr. H. L. Kellner, Chairman
Study of Application Technique in the Use of Liquid Buffing Compounds—E. T. Candee, S. L. Rens 521, 647
The Sisal Story—H. J. McAleer 522, 647
Barrel Plating—Chicago Branch (P. Glab) 522, 647
Industrial Chromium Plating—A Film (A. Logozzo) 522, 648
Fifth Educational Session, Dr. A. Brenner, Chairman
Further Studies of Nickel-Iron Electrodeposits—I. W. Wolf 522, 648
Iridium Plating and its High Temperature Oxidation Resistance—J. C. Withers and P. E. Ritt 522, 648
Surface Reduction of Copper—A. F. Cahill 522, 648
Sixth Educational Session, Dr. R. A. Schaefer, Chairman
Sealing of Anodic Aluminum Oxide Films—R. C. Spooner 522, 648
Study of Effect of Various Forming Electrolytes on the Anodic Film—J. M. Andrus 522, 649
Impurities in Chemical Bright Dip Solutions For Aluminum—Their Effect and Removal—R. F. Ledford 522, 649
Role of Chromate Treatments in the Finishing of Aluminum—W. E. Pocock 522, 649
Annual Report of AES Officers
President, Dr. S. Heiman 623
1st Vice President, F. T. Eddy 627
2nd Vice President, H. E. Head 628
3rd Vice President, R. D. Wysong 628
Past President, C. Kelly 629
Executive Secretary, J. P. Nichols 630
Research Chairman, A. H. DuRose 633
AES and Organic Coatings, The, R. D. Wysong (Editorial) 231
AES Boards and Committees 636
AES Branch Directory 64, 638
AES Branch Directory Changes 218, 339, 444, 819, 1134, 1354
AES Bronze Medal Award, Properties of Electrodeposits at Elevated Temperatures, W. H. Safranek and G. R. Schaer, Honored at the Society's 44th Annual Convention 783
AES Constitution, Proposed Changes in the, Dr. G. P. Swift 486
AES Constitution and Bylaws, Notice of Proposal to Amend, F. T. Eddy 1205
Chairmen of 1957–1958 AES Boards and Committees—E. T. Candee, Structure of the Society Committee; R. A. Ehrhardt, Research Committee; M. Glover, Law Committee; H. E. Head, Educational Committee; Dr. H. L. Kellner, Paper Awards Committee; J. P. Nichols, Editorial Board; Dr. R. Schaefer, Publications Committee; F. Tirendi, Public Relations Committee; Dr. W. A. Wesley, Branch Exhibits Committee; C. Wise, Cincinnati Convention; R. D. Wysong, Membership Committee 985
Constitution of the American Electroplaters' Society (As of July 1, 1957) 986
Conventions
AES Convention Site (Cincinnati Sheraton-Gibson) 1203
Branch Leadership fo the 45th Annual Convention—Cincinnati, Ohio, N 19–22, 1958:
C. Wise, Chairman 1309
E. A. Blount, Co-Chairman 1309
R. D. Miller, Educational; W. B. Stephenson Jr. 1095, 1309
S. Chipman, Entertainment 1095, 1309
A. J. Gerada, Athletic 1095, 1309
R. A. Barry, Plant Visitation 1095, 1309
A. R. Waters, Banquet 1095, 1309
R. K. Rarick, Finance 1095, 1309
Mrs. R. D. Miller, Ladies 1095, 1309
L. A. Critchfield, Co-ordination 1095, 1309
W. W. Loveless, Hotel 1095, 1309
L. J. Howard, Publicity 1095, 1309
E. Roof, Registration 1095, 1309
R. Winterman, Program 1095, 1309
D. Kaplan, Secretary 1095, 1309
Mrs. W. Young, Co-Chairman, Ladies 1309
Convention and Exposition Chairmen and Co-Chairmen:
E. A. Blount, Co-Chairman, Cincinnati 1958; G. J. Hetz, Co-Chairman, Los Angeles 1960; W. Wilson, Convention Chairman, Detroit 1959; H. J. McAleer, Chairman, Detroit Exposition 1959; M. Ben, Co-Chairman, Detroit Exposition 1959; T. Stabile, Convention Chairman, Los Angeles 1960 985
44th Annual Convention in Retrospect 891
45th Annual Convention Plans Forging Forward 1308
Outstanding 1958 Convention in Prospect 1094
Your 1958 Convention Host (That Cincinnati Branch) 1202
Montreal Convention
Abstracts of 44th Annual AES Convention 520, 644
Canadian Plants to Welcome AES Convention Visitors 296
AES Conventioneers 70
AES Ladies: Welcome, Mrs. G. Ross, Davidson, Ladies' Chairman 643
Convention Chairmen:
Banquet Committee, B. T. Kelly 408, 651
Educational Committee, P. M. Coady 408, 651
Educational Co-Chairman, Dr. J. Kane 651
Entertainment Committee, J. G. Carrique 408, 651
Finance Committee, B. Mendels 408, 651
General Chairman, G. R. Davidson 408, 651
Hotel Committee, S. A. Frost 408, 651
Ladies' Committee, Mrs. G. R. Davidson 408, 651
Plant Visitation Committee, M. Cohen 408, 651
Printing Committee, J. T. Reisenburg Jr. 408, 651
Program Committee, W. Glover 408, 651
Publicity Committee, J. T. Reisenburg Sr. 408, 651
Registration Committee, W. Feeley 408, 651
Transportation and Outing Committee, C. M. Douglas 408, 651
Honored at the Society's 44th Annual Convention—The Carl Heussner Award—"Current Distribution on Microprofiles"—Dr. D. G. Foulke and Dr. O. Kardos; The George B. Hogaboom Memorial Award—"Dissolved Gases in Plating Baths"—W. M. Tucker and F. O. Beuckman; The AES Bronze Medal Award—"Properties of Electrodeposits at Elevated Temperatures"—W. H. Safranek and G. R. Schaer; The Robert S. Leather Award—"Mechanical Finishing of Precision Parts"—L. H. Hopewell; The Chromium Plating Award—"Chromium Plating of Gun Bores"—Dr. V. A. Lamb and J. P. Young; The Precious Metal Plating Award—"Gold-Silver Alloy Plating—Dr. R. E. Harr and A. G. Cafferty 783
Message to AES From His Worship Mayor Jean Drapeau 643
Montreal Convention and the AES's Ladies 899
Paris of New World: Next Convention's Colorful Site 190
Program of Events 518
Chairmen Session—C. F. Nixon, Chairman, First Session; W. L. Pinner, Chairman, Second Session; A. West Chairman, Third Session; H. L. Kellner, Chairman, Fourth Session; A. Brenner, Chairman, Fifth Session; R. A. Schaefer, Chairman, Sixth Session 518, 649
Tentative Montreal Convention Papers 409
Tentative Schedule of Events 408
Welcome AES Members—G. Ross Davidson, General Convention Chairman 643
AES Directory 112, 218, 339, 444, 552, 728, 829, 936, 1036, 1136, 1252, 1356
Fifth Interim Meeting, Indianapolis, January 11, Interim Meeting Reporter 1153, 1285
AES Membership Competition 652
AES Membership Report 78, 201, 319, 425, 549, 818, 927, 1035, 1135, 1250
National Officers—1957–1958—President, F. T. Eddy; 1st Vice President, H. E. Head; 2nd Vice President, R. D. Wysong; 3rd Vice President, Dr. W. A. Wesley; Past President, Dr. S. Heiman; Executive Secretary, J. P. Nichols 777
AES RESEARCH
The AES Research Program in Over-All, R. A. Ehrhardt, Vice Chairman, Research 489
Financing AES Research, A. P. Wrisberg, Vice Chairman, Finance 490
Research Reports
Effects of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. II. The Effect and Removal of Calcium (Project No. 5), A. J. Smith and R. Bacon 186
Accelerated Corrosion Tests for the Permanence of Plated Coatings (Fourth Progress Report, Project 15), W. L. Pinner 763
Microthrowing Power, A Literature Search (Project 17), E. B. Leffler and H. Leidheiser Jr. 388
Summaries of AES Research Projects
The Spotting of Plated or Finished Metals, W. P. Barrows 493
Stripping of Copper from Various Base Metals (Project No. 1), F. C. Mathers 493
Determination of Impurities in Electroplating Solutions; Major Constituents; Cyanides in Plating Wastes (Project No. 2), E. J. Serfass 504
Adhesion of Electrodeposits (Project No. 3), A. L. Ferguson 494
The Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings (Project No. 4), G. J. Kahan 495
Effect of Impurities in Nickel Plating Solutions (Project No. 5), A. J. Smith 501
Porosity of Electrodeposited Metals (Project No. 6), N. Thon 495
Methods for Testing Thickness of Electrodeposits (Project No. 7), H. J. Read 496
Polarization and Overvoltage (Project No. 8), R. A. Schaefer 497
Physical Properties of Electrodeposited Metals—Nickel (Project No. 9), A. Brenner 497
Disposal of Plating Room Wastes (Project No. 10), B. F. Dodge 507
Current and Metal Distribution in Electrodeposition (Project No. 11), J. Kronstein 498
Cleaning and Preparation of Metals for Electroplating (Project No. 12), H. B. Linford 507
Nature, Cause and Effect of the Porosity in Electrodeposits (Project No. 13), F. Ogburn 508
Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating (Project No. 14), M. H. Jones 501
Accelerated Corrosion Tests (Project No. 15), W. L. Pinner 502
Mechanism of Electrodeposition (Project No. 16), J. O'M. Bockris 505
Mechanical Finishing of Metal Surfaces (Project No. 18), C. Kelly 509
Summaries of Completed AES Research Projects
Throwing Power in Chromium Plating (Concluded 1929), Porosity of Electroplated Chromium Coatings (Concluded 1931), Protective Value of Nickel and Chromium Plating on Steel (Concluded 1934), Accelerated Tests of Nickel and Chromium Plating on Steel (Concluded 1934), Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel (Concluded 1935), Outdoor Exposure Tested of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals (Concluded 1940), Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings (Concluded 1944) 767–768–769–770
Over-All Summary, Projects 2, 16 and 17, F. A. Lowenheim, District Supervisor 503

Page

Over-All Summary, Projects 5, 14 and 15, C. F. Nixon, District Supervisor ... 499
Summaries of Projects 10, 12 and 13, C. H. Sample, District Supervisor ... 506
Authors of AES Convention Papers, Pictures ... 644
AES Western Advertising Representative, Bob Wettstein ... 652
Aggressive Champion of the Plating Industry's Future, A. H. DuRose, Chairman, AES Research Committee (Editorial) ... 455
Airfoil Sections, Making—No. 2,776,253, January 1, 1957—E. School (Pat. Abs.) ... 515
Allen, C. and J. Stroh
Low-Cost Integrated Waste Treatment at American Sterilizer ... 869
Biography ... 872
Aluminum
Aluminum Oxide Films—No. 2,790,037, July 2, 1957—P. Robinson (Pat. Abs.) ... 1315
Aluminum Process—No. 2,788,317, April 9, 1957—C. Sonnino (Pat. Abs.) ... 1127
Anodized Aluminum for Automobile Trim Parts, C. F. Nixon and H. A. Kahler ... 156
Coating Ferrous Metals with Aluminum—No. 2,785,084, March 12, 1957—H. Lundin (Pat. Abs.) ... 1006
Decorating Anodized Aluminum—No. 2,778,790, January 22, 1957—C. Sobol (Pat. Abs.) ... 912
Detection of Chemical Protective Films on Aluminum and Aluminum Alloys, A. J. Raffalovich and S. Firestone (Art. Ref.) ... 906
Developments in the Field of Chemical Brightening of Aluminum (and Aluminum Magnesium Alloys), R. Lattey and H. Neunzig (Art. Ref.) ... 72
Electrodepositing Aluminum—No. 2,763,605, September 18, 1956—M. Miller and C. Baker (Pat. Abs.) ... 68
Electrodeposition of Metals from Organic Solutions. II. Further Studies on the Electrodeposition of Aluminum From a Hydride Bath, J. H. Connor and A. Brenner (Art. Ref.) ... 194
Etching Aluminum—No. 2,795,490, June 11, 1957—K. Newman, et al. (Pat. Abs.) ... 1211
Etching Aluminum—No. 2,796,334, June 18, 1957—D. Robinson (Pat. Abs.) ... 1232
Etching Aluminum and Its Alloys—No. 2,762,694, September 11, 1956—K. Newman (Pat. Abs.) ... 68
Influence of Surface Roughness on the Corrosion-Resistance of Plain and Anodized Pure Aluminum, R. Lattey and H. Neunzig (Art. Ref.) ... 194
Method for Glossing Articles Made of Aluminum—No. 2,756,131, July 24, 1956—H. Neunzig (Pat. Abs.) ... 188
Practical Aspects of Aluminum Hardcoating, A. W. Sweet ... 1191
Preparing Aluminum Cables for Soldering—No. 2,761,792, September 4, 1956—B. Wasserman (Pat. Abs.) ... 302
Removal of Oxide from Aluminum by Brazing Fluxes, The, M. F. Jordan and D. R. Milner (Art. Ref.) ... 194
Sealing Anodized Aluminum—No. 2,767,134, October 16, 1956—K. Hampel (Pat. Abs.) ... 515
Sprayed Aluminum and Zinc in Corrosive Environments, R. E. Mansford (Art. Ref.) ... 72
Studies of the Mechanism of Brightening of Aluminum and Aluminum Alloys. II. (German), F. Baumann and H. Ginsberg (Art. Ref.) ... 308
Surface Treatment and Finishing of Aluminum and Its Alloys, S. Wernick and R. Pinner (Art. Ref.) ... 308
Treating of Aluminum—No. 2,785,098, March 12, 1957—G. Cunningham and M. Levitin (Pat. Abs.) ... 1100
Ames, B. F.
New Developments in the Field of Organic Coatings ... 266
Biography ... 268
Analysis
Analysis of Phosphating Solutions. Colorimetric Determination of Nitrate, Lloyd O. Gilbert (Art. Ref.) ... 906
Determination of Copper in Nickel Solutions, T. A. Downey ... 383
Determination of Impurities in Electroplating Solutions; Major Constituents; Cyanides in Plating Wastes (Project No. 2), E. J. Serfass, AES Research ... 504
Determination of Iron in Chromium Plating Solutions, Dr. H. W. Dettner (Art. Ref.) ... 412
Determination of Lead in Lead Fluoborate Solutions, G. Gabrielson (Art. Ref.) ... 690
Electrolytic Analysis of Copper Metal from Cyanide Solution, Dr. W. O. Dow Jr. and G. Bakker ... 969
New Method for the Determination of Sulfate in Chromium Plating Solutions, A. C. J. Keattch ... 412
Photometric Determination of Molybdenum in Zinc Cyanide Plating Solutions, J. P. Leftin ... 380
Polarographic Analysis of Tin and Tin Alloy Plating Solutions, The, A. E. Knotowicz and J. V. Petrocelli ... 602

Page

Spectrophotometric Determination of Nickel in Bright Cadmium and Bright Gold Plating Solutions, N. F. Doherty ... 971
Andrew, R. H. and J. L. Duvall
Dimensional Etching—Its Application to Airframes ... 1186
Biography ... 1190
Anodes
Electroplating Anode Structure—No. 2,782,159, February 19, 1957—E. Berry (Pat. Abs.) ... 1003
Plating with Insoluble Anodes—Counteracting the Effects on a Silver Plating Solution, E. B. Jorcyzk (Pat. Abs.) ... 692
Use of Graphite as Duct Anodes, The, A. L. Ayres (Art. Ref.) ... 412
Use of High Silicon Cast Iron for Anodes (Art. Ref.) ... 412
Anodizing
Anodic Formation of Oxide Films on Silicon, P. F. Schmidt and W. Michel (Art. Ref.) ... 906
Anodized Aluminum for Automobile Trim Parts, C. F. Nixon and H. A. Kahler ... 156
Defective Spots in Anodically Oxidized and Dyed Sheet and Means for Their Avoidance (German), F. E. Farrell (Art. Ref.) ... 804
Density and Porosity of Anodic Coatings on Aluminum, R. B. Mason (Art. Ref.) ... 1126
Hard Anodizing of Aluminum D.T.D. Specification (Art. Ref.) ... 805
Investigation of the Anodic Processes of Aluminum Electropolishing by Means of Perchloric Acid—Alcohol Electrolytes, V. Hansen and E. Knuth-Winterfeldt (Art. Ref.) ... 308
Nondestructive Thickness Measurement of Anodizing Using the Interference Microscope, R. L. Saur ... 1079
Processes During Chemical and Anodic Polishing of Metal Surfaces, H. Brunner (Art. Ref.) ... 308
Racks for Anodizing, J. E. Bunch (Art. Ref.) ... 1028
Surface Treatment and Finishing of Light Metals. Part XII-B. Plating on Aluminum—Anodic Oxidation Processes, S. Wernick and R. Pinner (Art. Ref.) ... 194
Answer Lies With Your, The, J. P. Nichols (Editorial) ... 351
Article References, W. M. Tucker 72, 194, 308, 412, 690, 804, 906, 1028, 1125, 1226, 1328
Asphyxia: Are Your Ready for a Crisis? J. B. Dunne (Art. Ref.) ... 1227
ASTM
ASTM Designation: B-57T—Proposed Tentative Recommended Practice for Preparation of Lead and Lead Alloys for Electroplating ... 1104
ASTM Methods for Chemical Analysis of Metals (Books) ... 252
1956 Proceedings, American Society for Testing Materials, Volume 56 (Books) ... 1027
Semi-Annual Meeting—Committee B-8; American Society of Testing Materials, October 17-18, 1957, Hotel Benjamin Franklin, Philadelphia, Pa. Summary by Dr. E. B. Saubestre ... 1318
ASTM Standards on Zinc-Coated Iron and Steel Products (A-5) (Books) ... 252
Aves, W. L. Jr.
How Corrosion is Reduced on Landing Gear Pistons ... 1175
Biography ... 1179
Azzolino, J.
Lead-Tin Alloy Plating for Aircraft Engine Components ... 1180
Biography ... 1182

B

Bacon, R. and A. J. Smith
AES Research Project 5—Effects of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. II. The Effect and Removal of Calcium ... 186
Bair, R. B. and H. L. Benner
Effects of Impurities in Cyanide Plating Solutions ... 151
Biography ... 155
Bakker, G. and Dr. W. O. Dow Jr.
Electrolytic Analysis of Copper Metal from Cyanide Solution ... 969
Biography ... 970
Barrel
Apparatus for Barrel Plating Small Articles—No. 2,766,201, October 9, 1956—E. Luther (Pat. Abs.) ... 514
Barrel Finishing, A. S. Kohler (Art. Ref.) ... 1125, 1226
Barrel Finishing—Deburring and Allied Processes, A. S. Kohler (Art. Ref.) ... 1328
Barrel Finishing—How and When to Use, Lester F. Spencer (Art. Ref.) ... 804
Barrel Finishing with Steel Balls and Shapes, C. B. Schaefer and R. G. Messenger ... 40
Barrel Tumbling: How to Get Best Results, R. W. Fitch (Art. Ref.) ... 1328
Burr Removal by Barrel Finishing—C. F. Garnham (Art. Ref.) ... 692
Role of Modern Barrel Finishing, The, C. J. Glasrud ... 47

Page

Barrows, W. P.
The Spotting of Plated or Finished Metals (AES Research) ... 493
Barrows, W. P., W. Blum, A. Brenner
The Porosity of Electroplated Chromium Coatings, Summaries of AES Completed Research Projects ... 768
Barry, R. A. (Plant Visitation), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Bearings, Plated Aluminum—No. 2,766,195, October 9, 1956—E. Combs, C. Faust and G. Schaer (Pat. Abs.) ... 406
Bearing and Method of Making—No. 2,765,520, October 9, 1956—C. Donley (Pat. Abs.) ... 406
Ben, M., Co-Chairman, Detroit Exposition 1959, Convention and Exposition Chairmen and Co-Chairmen ... 985
Benner, H. L. and R. B. Bair
Effects of Impurities in Cyanide Plating Solutions ... 151
Biography ... 155
Beryllium—Electrodeposition of Metals from Organic Solutions. IV. Electrodeposition of Beryllium and Beryllium Alloys, G. B. Wood and A. Brenner (Art. Ref.) ... 412
Better Appliance Finishes by Flow-Coating with Epoxies, E. F. H. Strauss (Art. Ref.) ... 1329
Beuckman, F. O. and W. M. Tucker
Dissolved Gases in Plating Bath; George B. Hogaboom Memorial Award—44th Annual Convention ... 763
Bibliography on Metal Finishing Wastes, 1955, C. F. Garnham and D. G. Foulke ... 688
Bibliography on Metal Finishing Wastes, 1956, C. F. Garnham and D. G. Foulke ... 916
Biography
Allen, C. ... 872
Ames, B. F. ... 268
Andrew, R. H. ... 1190
Aves, W. L., Jr. ... 1179
Azzolino, J. ... 1182
Bair, R. B. ... 155
Bakker, G. ... 969
Benner, H. L. ... 155
Borushko, M. ... 262
Brenner, A. ... 601, 1305
Brodell, F. P. ... 601
Bueltman, C. F. ... 883
Castellano, E. N. ... 1085
Cohen, B. ... 968
Davidson, H. R. ... 278
De Minjer, C. H. ... 1035
Doherty, N. F. ... 974
Dow, W. O., Jr. ... 970
Downey, T. A. ... 385
Duvall, J. L. ... 1190
Field, G. C. ... 387
Foran, N. ... 1078
Foulke, Dr. D. G. ... 863
Glasrud, C. J. ... 51
Glover, G. E. ... 165
Gough, C. L. ... 883
Garnham, Dr. C. F. ... 878
Hemmerdinger, H. ... 278
Hill, E. A. ... 868
Hopewell, L. H. ... 39
Kahler, H. A. ... 166
Knotowicz, A. E. ... 606
Leffler, F. B. ... 396
Leftin, J. P. ... 382
Leidheiser, H. Jr. ... 396
Long, S. A. ... 1185
Long, T. F. ... 974
McTague, R. F. ... 265
Messenger, R. G. ... 42
Milne, D. ... 863
Nelsen, E. W. ... 55
Neff, F. J. ... 868
Nixon, C. F. ... 160, 762
Nowacki, L. J. ... 775
Petrocelli, Dr. J. V. ... 602
Pinner, W. L. ... 748
Pope, J. A. ... 1296
Saur, R. L. ... 1082
Schaefer, C. B. ... 42
Seward, W. K. ... 46
Shapiro, H. ... 611
Stroh, J. ... 952
Sweet, A. W. ... 1196
Wertman, H. P. ... 396
Black Oxide Coatings on Steel: Quality Tests, J. Doss (Art. Ref.) ... 1329
Blount, E. A., Co-Chairman, Branch Leadership of the 45th Annual Convention ... 1095, 1309
Blount, E. A., Convention and Exposition Chairmen and Co-Chairmen ... 985
Blueprint for Your Society's Further Growth, R. D. Wyeng (Editorial) ... 1047
Blum, W. W. P. Barrows, A. Brenner
The Porosity of Electroplated Chromium Coatings, Summaries of AES Completed Research Projects ... 768
Blum, W. and H. L. Farber
Throwing Power in Chromium Plating, Summaries of Completed AES Research Projects ... 767
Blum, W., G. A. Lux
Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings, Summaries of Completed AES Research Reports ... 770
Blum, W. and P. W. Strausser
Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals, Summaries of Completed AES Research Projects ... 770

Page

Blum, W., P. W. Strausser, A. Brenner
Protective Value of Nickel and Chromium Plating on Steel, Summaries of Completed AES Projects ... 768
Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel, Summaries of Completed AES Research Projects ... 769
Bockris, J. O'M.
Mechanism of Electrodeposition (Project No. 16), AES Research ... 505
Books
ASTM Methods for Chemical Analysis of Metals ... 252
ASTM Standards on Zinc-Coated Iron and Steel Products (A-5) ... 252
Chemical Surface Treatment of Titanium by H. A. Pray, P. D. Miller and R. A. Jeffreys ... 787
Corrosion of Titanium, by D. W. Stough, F. W. Fink and R. S. Peoples ... 688
Corrosion Preventive Additives by E. J. Schwoegler and L. U. Berman ... 688
Design Properties in High-Strength Steels in the Presence of Stress Concentrations and Hydrogen Embrittlement: Part 3—The Response of High-Strength Steels in the Range of 180,000-300,000 psi to Hydrogen Embrittlement from Cadmium Electroplating, E. P. Klier, B. B. Muvdi, and G. Sachs ... 1339
Development of a Protective Coating Resistant to Nitric Acid and Hydrocarbons, D. F. Siddall, E. Hillier, R. Garling and M. Gunther ... 378
Electrodeposition of Titanium. Part 3 by by W. E. Reed Jr., H. Connor and A. Brenner ... 688
Electrolytic and Chemical Polishing of Metals in Research and Industry, W. J. McG. Tegart ... 378
Electroplating Baths for Ultra-High Strength Steels. Part I—Use of Aliphatic Amino Acids in Cadmium Baths to Reduce Hydrogen Embrittlement—P. N. Vlannes, S. W. Strauss, and B. F. Brown ... 1027
Ferrous Metals—Part 1, 1956 Supplement to ASTM Standards ... 252
Finishing Handbook and Directory 1957 ... 688
Fundamental Studies on the Adhesion of Organic Materials to Metal Substrates—R. L. Patrick and W. A. Vaughan ... 1027
Industrial Water and Industrial Waste Water. ASTM Special Technical Publication No. 207 ... 1116
Manual on Industrial Water ... 688
Non-Ferrous Metals—Part 2, 1956 Supplement to ASTM Standards ... 252
Preparation of Protective Coatings by Electrophoretic Methods, A. C. Werner ... 1339
Principles of Laboratory Temperature Control, Electronic Relays, Thermistor Operated Control, C. M. Proctor ... 378
1956 Proceedings, American Society for Testing Materials, Volume 56 ... 1027
Research and Development on Electrodeposition of New Chromium and Chromium-Alloy Plate, L. D. McGraw ... 1339
Simultaneous Polarographic Determination of Cadmium and Tin by G. W. Latimer, C. D. Houston and K. E. Eubank ... 688
Solvent Extraction in Analytical Chemistry, G. H. Morrison and H. Freiser ... 1116
Stress Corrosion Cracking and Embrittlement ... 378
Study of the Feasibility of Coating Magnesium with High Purity Aluminum, A, by C. F. Powell and I. E. Campbell, Battelle Memorial Institute for Wright Air Development Center November 1956 ... 853
Surface Treatment of Low Alloy Steel, Sam Tour (Reviewed by W. H. Safranek) ... 852
Symposium of pH Measurement—ASTM Special Technical Publication 190 ... 852
Symposium on Properties, Tests and Performance of Electrodeposited Metallic Coatings ... 398
Tinplate Handbook, W. E. Hoare ... 378
Borushko, M.
Painting and the Plater ... 260
Biography ... 262
Brazed Ferrous Metal Parts—No. 2,755,542, July 24, 1956—A. Boegehold (Pat. Abs.) ... 180
Brazing of Molybdenum and Tungsten—No. 2,775,809, January 1, 1957—R. S. Steinitz (Pat. Abs.) ... 789
Breaking Barriers, W. A. Wesley (Editorial) ... 1147
Brenner, A.
Chairman, Fifth Session, Montreal Convention ... 519, 649
Physical Properties of Electrodeposited Metals—Nickel, (Project No. 9), AES Research ... 497
Biography ... 601, 1305
Brenner, A., W. Blum, W. P. Barrows
The Porosity of Electroplated Chromium Coatings, Summaries of AES Completed Research Projects ... 768
Brenner, A., W. Blum, P. W. Strausser
Protective Value of Nickel and Chromium Plating on Steel, Summaries of Completed AES Projects ... 768
Brenner, A. and F. P. Brodell
Further Studies of an Electronic Thickness Gage ... 591

Page

Brenner, A. and C. H. de Minjer
Studies on Electroless Nickel Plating ... 1297
Brenner, A., P. W. Strausser, W. Blum
Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel, Summaries of Completed AES Research Projects ... 769
Brodell, F. P. and A. Brenner
Further Studies of an Electronic Thickness Gage ... 591
Brodell, F. P.
Biography ... 601
Brown, B. F. (Office of Naval Research)
Excerpts from the Naval Research Laboratory Report: Effect of Baking on Delayed Fracture of Electroplated Ultra High-Strength Steel ... 1114
Buelt man, C. F. and C. L. Gough
Operating Experiences with Chromic Acid Recovery Equipment ... 879
Buelt man, C. F.
Biography ... 883
Buffing and Polishing
Abrasive Finishing of Metals, Picture Story ... 32
Abrasive Wheel—No. 2,796,337, June 18, 1957—A. Block (Pat. Abs.) ... 1235
Apparatus for Applying Abrasive to Buffing Wheels—No. 2,763,971—September 25, 1956—N. Anderson (Pat. Abs.) ... 404
Article Burnishing Means—No. 2,786,308, March 26, 1957—C. Kinker (Pat. Abs.) ... 1101
Automatic Buffing Machine—No. 2,765,590, October 9, 1956—S. Belejack and N. Feingold (Pat. Abs.) ... 406
Bias Buff and Method of Making Same—No. 2,783,594, March 5, 1957—A. Rock (Pat. Abs.) ... 1005
Buffing Process—No. 2,780,041, February 5, 1957—H. Larsen (Pat. Abs.) ... 1000
Buffing Composition—No. 2,763,223, October 2, 1956—E. Candee and S. Doughty (Pat. Abs.) ... 404
Buffing Wheel—No. 2,779,142, January 29, 1957—J. Wisnieski (Pat. Abs.) ... 1000
Buffing Wheel Hub—No. 2,785,516, F. March 19, 1957—F. Hendrickson (Pat. Abs.) ... 1109
Buffs for All Purposes, E. F. Doyle (Art. Ref.) ... 194
Electrolytic Grinding Apparatus—No. 2,778,794, January 22, 1957—G. Comstock III (Pat. Abs.) ... 912
High Speed Rotary Buffs—No. 2,767,525, October 23, 1956—M. Schloss (Pat. Abs.) ... 514
Metal Blasting Material—No. 2,796,338, June 18, 1957—R. Haberl (Pat. Abs.) ... 1235
Metal Polishing with Setup Wheels, R. S. Burt (Art. Ref.) ... 414
Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings (Concluded 1944), Summaries of Completed AES Research Projects, G. A. Lux, W. Blum ... 770
Molded Abrasive—No. 2,800,403, July 23, 1957—W. Boeke, et al. (Pat. Abs.) ... 1317
Points to Remember in Using Abrasive Belts for Finishing, W. K. Seward (Art. Ref.) ... 308
Properly Formulated Buffing Compounds Can Make Cleaning Easier, E. Van Zandt (Art. Ref.) ... 194
Reduction of Wear and Whiskers by Electrolytic Polishing (French), J. Heyes (Art. Ref.) ... 1226
Removing Rust and Scale by Abrasive Cleaning, F. Jacobson (Art. Ref.) ... 1029
The Surface Treatment of Aluminum and Its Alloys. I. Machine Polishing, C. Etienne and F. Flusin (Art. Ref.) ... 72
Wetting Agents and Buffers in Cleaning and Electroplating, E. Engel (Art. Ref.) ... 414
Burnishing a Method for Improving the Surface Finish without Removal of Metal (German), H. Konig (Art. Ref.) ... 1328
Burnishing Wheel—No. 2,763,105, September 18, 1956—J. Feeley (Pat. Abs.) ... 68

C

Cadmium Anodes and Cadmium Oxide for Electroplating (British Standard Specification) (Art. Ref.) ... 1329
Cadmium
Cadmium, Deposition of, by Chemical Reduction—No. 2,790,733, April 30, 1957—D. Couch (Pat. Abs.) ... 1206
Cafferty, A. G. and Dr. R. E. Harr
Gold-Silver Alloy Plating, Precious Metal Plating Award—44th Annual Convention ... 783
Canadian Plants to Welcome AES Convention Visitors, Montreal Convention ... 296
Candee, E. T.
Structure of the Society Committee, Chairmen of 1957-1958 AES Boards and Committees ... 985
Candidates for National Third Vice President, G. W. Cavanaugh, L. O. Gilbert, Dr. E. J. Serfass, Dr. W. A. Wesley ... 426
Carl Heussner Award
"Current Distribution on Microprofiles"—Dr. D. G. Foulke and Dr. O. Kardos, 44th Annual Convention ... 783

Page

Carrique, J. G.
Entertainment Committee, Montreal Convention ... 408, 651
Castellano, E. N.
Bright Nickel Plating in the Costume Jewelry Industry ... 1083
Biography ... 1085
Cavanaugh, G. W.
Candidates for National Third Vice-President ... 426
Cathode Grids, Electrodeposited—No. 2,795,032, June 4, 1957—D. Kerstetter (Pat. Abs.) ... 1211
Ceramic Structures, Metalized, February 5, 1957—L. LaForge (Pat. Abs.) ... 1001
Chelating Agents in Metal Cleaning and Derusting, J. K. Aiken (Art. Ref.) ... 412
Chapman, S.
(Entertainment), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Chromium
Chromium Coatings, The Porosity of Electroplated, Summaries of AES Completed Research Projects, W. Blum, W. P. Barrows, A. Brenner (Associates) (National Bureau of Standards) ... 768
Chromium Plate Irregular Surfaces Uniformly, L. Rosenberg (Art. Ref.) ... 72
Chromium Plating, D. J. Fishlock (Art. Ref.) ... 194
Chromium Plating—No. 2,787,588, April 2, 1957—J. Stareck (Pat. Abs.) ... 1102
Chromium Plating—No. 2,787,589, April 2, 1957—J. Stareck (Pat. Abs.) ... 1103
Chromium Plating—No. 2,800,436, July 23, 1957—J. Stareck and E. Seyb (Pat. Abs.) ... 1317
Chromium Plating Award—Chromium Plating of Gun Bores, V. A. Lamb and J. P. Young, Honored at the Society's 44th Annual Convention ... 783
Chromium Plating from the Trivalent Bath, M. R. Zell (Art. Ref.) ... 308
Chromium Plating of Gun Bores, V. A. Lamb and J. P. Young, Chromium Plating Award—44th Annual Convention ... 783
Chromium Plating Over a Chromate Film. A Preliminary Study, J. E. Hoover (Art. Ref.) ... 308
Chromium Plating, Throwing Power in, H. L. Farber and W. Blum, Summaries of Completed AES Research Projects ... 767
Diffusion Chromium Coating Steel Surfaces—No. 2,791,517, May 7, 1957—G. Becker and F. Steinberg (Pat. Abs.) ... 1206
Electrodeposition of Chromium—No. 2,771,413, November 20, 1956—R. Dean (Pat. Abs.) ... 402
Electrodeposition of Chromium—No. 2,784,153, March 5, 1957—A. Du Rose (Pat. Abs.) ... 1005
Hard Chromium (Art. Ref.) ... 72
Investigation of Chromium Plating Baths of the Combined Type, N. T. Drobantseva and A. N. Synaev (Art. Ref.) ... 194
Method of Plating Chromium over Antimony—No. 2,764,538, September 25, 1956—C. Smart (Pat. Abs.) ... 404
Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals (Concluded 1940), Summaries of Completed AES Research Projects, W. Blum and P. W. Strausser ... 770
Repair of Car Parts by Chromium Plating, The, A. W. Rykowa (Art. Ref.) ... 804
Treating Chromium Surfaces—No. 2,788,292, April 9, 1957—W. Giesker and Richard Britton (Pat. Abs.) ... 1103
Cincinnati Sheraton-Gibson, AES Convention Site ... 1203
Clad Fabrication—No. 2,786,266, March 26, 1957—R. Fayles (Pat. Abs.) ... 1101
Cleaning
Cleaning Metal Strip—No. 2,800,420, July 23, 1957—R. Dunlevy, et al. (Pat. Abs.) ... 1317
Cleaning of Magnesium Base Alloy Castings—No. 2,766,199, October 9, 1956—W. Higgins (Pat. Abs.) ... 514
For Castings that Last, Get Base Metals Clean, S. J. Oechale Jr. and K. G. LeFevre (Art. Ref.) ... 1126
Cleaning and Finishing Forum on Technical Progress (Art. Ref.) ... 414
Cleaning and Preparation of Metals for Electroplating (Project No. 12), H. B. Linford, AES Research ... 507
Cleaning Metals and Alloys, C. B. F. Young (Art. Ref.), ... 72
Cleaning Plant—No. 2,788,616, April 9, 1957—H. Schultz and A. Berninger (Pat. Abs.) ... 1127
Electrolytic Cleaning of Metals, Process for—No. 2,760,928, August 28, 1956—H. Webster (Pat. Abs.) ... 302
Electrolytic Cleaning Method—No. 2,765,271, October 2, 1956—J. Kreml (Pat. Abs.) ... 406
Proper Cleaning Methods Pay Dividends, Lester F. Spencer (Art. Ref.) ... 906
Coudy, P. M.
Educational Committee, Montreal Convention ... 408, 651

Page

Coating
Amine Phosphate Coatings—No. 2,768,737, November 6, 1956—W. Russell (Pat. Abs.) 514
Chromate Conversion Coatings on Hot Dipped Galvanize, C. W. Ostrander (Art. Ref.) 1320
Coating—No. 2,767,105, October 16, 1956—J. Fletcher (Pat. Abs.) 515
Coating Aluminum—No. 2,798,829, July 9, 1957—N. Newhard and J. Carroll (Pat. Abs.) 1315
Coating Core Plates—No. 2,790,739, April 30, 1957—W. Frederick and O. Romig (Pat. Abs.) 1232
Coating Lead Strip—No. 2,800,416, July 23, 1957—E. Walters (Pat. Abs.) 1317
Coating Methods—No. 2,798,008, July 2, 1957—E. Miller (Pat. Abs.) 1315
Coating Process—No. 2,785,082, March 12, 1957—P. Clough and P. Godley (Pat. Abs.) 1006
Coating Process for Polyethylene—No. 2,786,780, March 26, 1957—W. Wallis and H. Hahn (Pat. Abs.) 1102
Coating Stainless Steel—No. 2,800,421, July 23, 1957—E. Goodspeed, et al. (Pat. Abs.) 1317
Coatings for Protection of Electroplating Equipment, Michael Perez (Art. Ref.) 906
Coatings for Use with Cathodic Protection (Art. Ref.) 414
Composition for Forming Black Coatings for Metal—No. 2,762,733, September 11, 1956—P. Borghetti and W. Cavanaugh (Pat. Abs.) 402
Development of a Production Unit for Spraying Catalyst Finishes—J. N. E. Fairrie (Art. Ref.) 692
Developments in Sprayed Metal Coatings (Art. Ref.) 72
Epoxy Coatings for Metal Products, R. E. Dunbar (Art. Ref.) 1028
Hardness Tester for Non-Conductive Organic Coatings 281
Hot Dip Aluminum Coating Process—No. 2,774,686, Dec. 18, 1956—A. Hodge (Pat. Abs.) 666
Measuring the Thickness of Sprayed Metal Coatings, R. E. Mansford (Art. Ref.) 1126
Metal Coating Corporation—No. 2,798,009, July 2, 1957—C. Gault (Pat. Abs.) 1315
Metal Spraying at Messrs. Tate and Lyle Ltd. Thames Refinery (Art. Ref.) 72
Metal Spraying in the Radio Industry, C. F. Fish (Art. Ref.) 72
Method and Apparatus for Spray Coating of Articles—No. 2,781,279, February 12, 1957—M. Miller (Pat. Abs.) 1002
Method for Coating Metals—No. 2,768,103, October 23, 1956—L. Schuster and A. Baldi (Pat. Abs.) 514
Method of Coating a Ferrous Metal Surface—No. 2,784,124, March 5, 1957—H. Moore (Pat. Abs.) 1005
Method of Coating a Metal Surface—No. 2,775,531, Dec. 25, 1956—E. Montgomery et al. (Pat. Abs.) 668
Method of Coating a Metal with Molybdenum—No. 2,783,164, February 26, 1957—M. Hill (Pat. Abs.) 1004
Method of Coating Metals with Amine Phosphate Coatings—No. 2,766,153, October 9, 1956—W. Russell (Pat. Abs.) 406
Method of Electrochemical Oxide Coating of Iron and Steel in Hot Concentrated Alkali Solution, V. V. Losev (Art. Ref.) 1028
Oxalate Coatings on Chromium Alloys—No. 2,774,696, December 18, 1956—R. Gibson (Pat. Abs.) 668
Oxalate Coatings on Steel—No. 2,791,525, May 7, 1957—W. Rausch and A. Mayr (Pat. Abs.) 1206
Phosphater Coating Composition—No. 2,790,740, April 30, 1957—R. Ayeres and E. Heinzelman (Pat. Abs.) 1206
Phosphate Coatings, S. Spring (Art. Ref.) 690
Preparation of Protective Coatings by Electro-Phoretic Methods, A. G. Werner, B. Triffleman, D. Rothacker and N. Ross (Art. Ref.) 72
Properties of Sprayed Zinc Coatings, E. Gebhardt and H. D. Seghezzi (Art. Ref.) 692
Protective Coatings for Aluminum—No. 2,788,289, April 9, 1957—N. Deuble (Pat. Abs.) 1103
Protective Coatings for Aluminum Alloys—No. 2,797,370, June 18, 1957—C. W. Ostrander (Pat. Abs.) 1314
Protective Coatings for Titanium (Art. Ref.) 1030
Protective Coatings in Industry—Review of Modern Synthetic Materials, E. A. Duligal (Art. Ref.) 1028
Solution for Cleaning and Coating Metal Surfaces—No. 2,762,732, September 11, 1956—R. Somers (Pat. Abs.) 304
Spray Painting with Compressed Air Atomization, A. B. Harvey (Art. Ref.) 1226
Sprayed Aluminum and Zinc in Corrosive Environments, R. E. Mansford (Art. Ref.) 72
Surface of Metallurgy of Protective Coatings—Charles L. Faust 804
Titanium Accelerated Oxalate Metal Coating Composition—No. 2,785,097, March 12, 1957—E. Goodspeed and R. Gibson (Pat. Abs.) 1006

Page

Trend of Protective Metal Spraying Practice, W. E. Stanton 72
Urethane Coatings—Tough, But Temperamental, H. B. Wagner (Art. Ref.) 1328
Use of Hot-Dip Strippable Coatings for the Protection of Spares, The, F. A. S. Wood and N. R. Kirkby (Art. Ref.) 194
Variables Affecting Coating Performance, J. I. Richardson (Art. Ref.) 194
Cohen, B.
Biography 968
Cohen, M.
Plant Visitation Committee, Montreal Convention 408, 651
Color Difference Specifications, H. Hemmendinger and H. R. Davidson 274
Committee B-8—American Society of Testing Materials, Semi-Annual Meeting, October 17–18, 1957, Hotel Benjamin Franklin, Philadelphia, Pa. Summary by Dr. E. B. Saubestre 1318
Composite Metals—No. 2,733,817, Dec. 11, 1956—J. Russell, et al. (Pat. Abs.) 664
Composition for Preparing Metal Surfaces—No. 2,793,961, May 28, 1957—G. Oven (Pat. Abs.) 1208
Composition for Treating Metals—No. 2,777,785—January 15, 1957—L. Schuster and A. Baldi (Pat. Abs.) 790
Control of Quality in Metal Finishing, A. Heward (Art. Ref.) 72
Conveyorized Finishing, Part II, J. E. Hyler (Art. Ref.) 194
Copper Coating by Galvania Action—No. 2,768,944, October 30, 1956—M. Meth, (Pat. Abs.) 514
Copper, Method for Protection of—No. 2,784,156, March 5, 1957—A. Maurin (Pat. Abs.) 1006
Copper Plating, Bright Acid—No. 2,758,076, August 7, 1956—F. Passal (Pat. Abs.) 298
Copper Plating Brightener—No. 2,778,788, January 22, 1957—D. R. France (Pat. Abs.) 912
Corrosion
Accelerated Corrosion Tests (Project No. 15), W. L. Pinner, AES Research 502
Accelerated Corrosion Tests for the Performance of Plated Coatings (Fourth Progress Report), W. L. Pinner 763
Application of a Systematic Scheme for Examining Corroded Metal Specimens—J. B. Cotton and R. J. Watkins (Art. Ref.) 690
Contamination and Corrosion in Rail Tank Cars, S. J. Oechsle Jr. and K. G. LeFevre (Art. Ref.) 308
Control of Corrosion with Zinc Coatings, J. L. Kimberley (Art. Ref.) 1030
Corrosive Properties and Passivation of Titanium and Its Alloys (German), Ulrich Zwicker (Art. Ref.) 906
Corrosion Commentary (Art. Ref.) 1328
Corrosion of Titanium, D. W. Stough, F. W. Fink and R. S. Peoples (Art. Ref.) 906
Corrosion Protecting Composition—No. 2,796,372, June 18, 1957—A. Chester and B. Jeremais (Pat. Abs.) 1314
Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel (Concluded 1935). Summaries of Completed AES Research Projects, W. Blum, P. W. Strausser, A. Brenner 769
Corrosion Research Laboratories—12 Ministry of Supply Outdoor Exposure Station, Glascoed, Wales. Testing Paints by Outdoor Exposure—Part 2, C. R. Edwards and E. Jenkins (Art. Ref.) 1126
Corrosion-Resistant Floors, V. Evans (Art. Ref.) 804
Corrosion-Resistant Floors. Part I (Art. Ref.) 906
Corrosion Resistant Structure—No. 2,771,985, November 27, 1956—R. Seymour (Pat. Abs.) 402
Corrosion Resistant Treatment for Steel, Zinc, and Aluminum—No. 2,795,518, June 11, 1957—J. Carroll and N. Mewhard (Pat. Abs. 1232
How Corrosion Is Reduced on Landing Gear Pistons, W. L. Ayes Jr. 1175
Laboratory Method for Corrosion Inhibitor Evaluation, G. A. Marsh and E. Schaschl (Art. Ref.) 72
Measurement of the Instantaneous Corrosion Rate by Means of Polarization Data, R. V. Skold and T. E. Larson (Art. Ref.) 412
Metallized Coatings for Heat Corrosion Protection, J. R. Franklin (Art. Ref.) 72
Method for Corrosion Protecting Articles—No. 2,796,361—A. Chester (Pat. Abs.) 1235
Method for Corrosion Rate of Metals—No. 2,786,021, March 19, 1957—G. Marsh (Pat. Abs.) 1101
Polyvinyl Chloride Pipe Handles Corrosive Plating Solutions, T. F. Long 975
Process of Retarding Corrosion—No. 2,784,122, March 5, 1957—N. Cox and G. Hoover (Pat. Abs.) 1005
Role of Corrosion Inhibitors in Water Treatment, E. L. Streatfield (Art. Ref.) 1125
Study of a Size Effect in Galvanic Corrosion, J. T. Waber (Art. Ref.) 412
Critchfield, L. A. (Co-ordination), Branch

Page

Leadership of the 45th Annual Convention 1095, 1309
Current and Metal Distribution in Electrodeposition (Project No. 11), J. Kronsbein, AES Research 498
Current Distribution on Microprofiles, Dr. D. G. Foulke and Dr. O. Kardos, The Carl Heussner Award—44th Annual Convention 783
Current Trends in Plating Waste Abatement, C. F. Gurnham 873
Cutting and Grinding, Electrical—No. 2,793,992, May 28, 1957—H. Heuser (Pat. Abs.) 1232
Cyanide Compositions Suitable for Electroplating Baths—No. 2,771,411, November 20, 1956—A. Chester and J. Irwin (Pat. Abs.) 402
Cyanide Waste—Oxidized in the Plating Room, E. A. Hill and F. J. Neff 864

D

Davidson, Mrs. G. Ross
Ladies' Chairman, AES Ladies' Welcome 643
Ladies Committee, Montreal Convention 408, 651
Davidson, G. B.
General Chairman, Montreal Convention 408, 651
General Convention Chairman, Welcome AES Members 643
Biography 278
Davidson, H. B. and H. Hemmendinger
Color Difference Specifications 274
Decorative Metal Plating—No. 2,780,591, February 5, 1957—S. Frey (Pat. Abs.) 1001
De Minjer, C. H. and A. Breuner
Studies on Electroless Nickel Plating 1297
De Minjer, C. H.
Biography 1305
Deposition of Metal Films from Carbonyls—No. 2,759,848, August 21, 1956—M. Sullivan (Pat. Abs.) 300
Descaling Metals—No. 2,794,001, May 28, 1957—G. Carter (Pat. Abs.) 1210
Descaling Metals—No. 2,796,336, June 18, 1957—G. Carter (Pat. Abs.) 1235
Design and Construction of a New Plating Department, R. I. Horrocks (Art. Ref.) 414
Design Properties in High-Strength Steels in the Presence of Stress Concentrations and Hydrogen Embrittlement: Part 3—The Response of High-Strength Steels in the Range of 180,000–300,000 psi to Hydrogen Embrittlement from Cadmium Electroplating, E. P. Klier, B. B. Muvdi, and G. Sachs (Books) 1339
Determination of Impurities in Electroplating Solutions; Major Constituents—Cyanides in plating Wastes, Project No. 2, E. J. Serfass, AES Research 504
Development of Plastisol Systems for the Metal Coating Industry 263
Development of a Protective Coating Resistant to Nitric Acid and Hydrocarbons, The, D. F. Siddall, E. Hillier, R. Garling and M. Gunther (Books) 378
Disposal of Plating Room Wastes (Project No. 10), B. F. Dodge, AES Research 507
Diveley, L.
Milwaukee Deals with the Allied Arts 306
Dodge, B. F.
Disposal of Plating Room Wastes (Project No. 10), AES Research 507
Doherty, N. F.
Spectrophotometric Determination of Nickel in Bright Cadmium and Bright Gold Plating Solutions 971
Biography 974
Douglas, C. M.
Transportation and Outing Committee, Montreal Convention 408, 651
Dow, Dr. W. O. Jr. and G. Bakker
Electrolytic Analysis of Copper Metal from Cyanide Solution 969
Dow, Dr. W. O. Jr.
Biography 970
Downey, T. A.
Determination of Copper in Nickel Solutions 383
Biography 385
Drapeau, Mayor Jean
Message to AES From His Worship Mayor Jean Drapeau, Montreal Convention 643
DuRose, A. H.
Aggressive Champion of the Plating Industry's Future (Editorial) 455
Research Chairman's Report 633
Duvall, J. L.
Biography 1190
Duvall, J. L. and R. H. Andrew
Dimensional Etching—Its Application to Airframes 1186

E

Economics of Treatment of Strong Chromic Acid Solutions, The, G. E. Glover 161
Eddy, F. T.
First Vice President's Report 627
1957–1958 National Officers President, AES 777
Notice of Proposal to Amend AES Constitution and Bylaws 1205
Vigor of Youth, The (Editorial) 831

Page

Editorials
AES and Organic Coatings, The, R. D. Wyseng ... 231
Aggressive Champion of the Plating Industry's Future, A, H. DuRose, Chairman, AES Research Committee ... 455
Answer Lies With You, The, J. P. Nichols ... 351
Blueprint for Your Society's Further Growth, R. D. Wyseng ... 1047
Breaking Barriers, W. A. Wesley ... 1147
Fringe Benefits, C. Kelly ... 123
Live and Learn, H. E. Head ... 947
The Industry, the AES and the Future, S. Heiman ... 563
This Message to You at Christmastime, J. P. Nichols ... 1263
Time Table in the Courtship of Knowledge ... 7
Vigor of Youth, The, F. T. Eddy ... 831
What Constitutes a State?, J. P. Nichols ... 739

Effect of Baking on Delayed Fracture of Electroplated Ultra High-Strength Steel (Excerpts from the Naval Research Laboratory Reports), B. F. Brown (Office of Naval Research) ... 1114

Effect of Certain Constituents of Tank Linings on Nickel Electrodeposits. An Investigation Covering Rubber and Plastic Materials, J. Edwards (Art. Ref.) ... 414

Effect of Impurities in Nickel Plating Solutions (Project No. 5), A. J. Smith, AES Research ... 501

Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings (Project No. 4), G. J. Kahan, AES Research ... 495

Effects of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. II. The Effect and Removal of Calcium, AES Research Project 5, A. J. Smith and R. Bacon ... 186

Effects of Impurities in Cyanide Plating Solutions, H. L. Benner and R. R. Bair ... 151

Ehrhardt, R. A.
AES Research Program in Over-All, The ... 489
Research Committee Chairmen of 1957-1958 AES Boards and Committees ... 985

Electrical Carbon Film Resistors—No. 2,778,743, January 22, 1957—B. Bowman (Pat. Abs.) ... 790

Electrical Recording Medium—No. 2,786,807, March 26, 1957—R. Schwartz (Pat. Abs.) ... 1102

Electro-Chemical Treatment—No. 2,763,608, September 18, 1956—C. Pool (Pat. Abs.) ... 68

Electrochemistry and the Plater, F. G. Brune (Art. Ref.) ... 1125

Electrodeposited Foils for Use As Magnetic Materials in Communication Technology, F. Khol (Art. Ref.) ... 1328

Electrodeposits at Elevated Temperatures, Properties of, W. H. Safranek and G. R. Schaer, AES Bronze Medal Award—44th Annual Convention ... 783

Electrofining Metal, Method for—No. 2,773,816, Dec. 11, 1956—A. Wesley and R. McKay (Pat. Abs.) ... 664

Electroformed from Articles—No. 2,758,961, August 14, 1956—L. Krowsky (Pat. Abs.) ... 300

Electroforming of Linear Accelerator Structures, J. A. Pope ... 1291

Electroforming Thin Films to Close Tolerances, R. W. Hampson (Art. Ref.) ... 1226

Electrolysis Cleans Titanium (Art. Ref.) ... 1029

Electrolyte for Copper Refining—No. 2,769,775, Nov. 6, 1956—J. Schoen and E. Elkin and K. Ekker (Pat. Abs.) ... 662

Electrolytic Apparatus—No. 2,771,415, Nov. 20, 1956—A. Ross (Pat. Abs.) ... 662

Electrolytic Cells—No. 2,786,063, March 19, 1957—C. Deperz (Pat. Abs.) ... 1101

Electrolytic Cladding—No. 2,786,809, March 26, 1957—R. Eaynes (Pat. Abs.) ... 1102

Electrolytic Coating, Porosity Dispersion in, M. Bonnemay (Art. Ref.) ... 308

Electrolytic Deposits, Stains on: Origin and Remedies (French), J. Liger (Art. Ref.) ... 805

Electrolytic Descaling, No. 2,780,594, February 5, 1957—J. Daily (Pat. Abs.) ... 1001

Electrolytic Erosion of Work Pieces—No. 2,798,846, July 9, 1957—G. Comstock (Pat. Abs.) ... 1316

Electrolytic Marking Device—No. 2,798,849, July 9, 1957—A. Lindsay (Pat. Abs.) ... 1316

Electrolytic Method for Cleaning Containers—No. 2,778,791, January 22, 1957—I. Duncan (Pat. Abs.) ... 912

Electrolytic Process for Salvaging Uranium—No. 2,773,820, December 11, 1956—R. Boyer and S. Kilmer (Pat. Abs.) ... 666

Electrolytic Protective Coating for Magnesium—No. 2,778,789, W. McNeill (Pat. Abs.) ... 912

Electrolytic Treating Apparatus—No. 2,793,993, May 28, 1957—R. Stock and John McLay (Pat. Abs.) ... 1210

Electrolytic Treatment of Articles, Apparatus for Continuous—No. 2,764,542, September 25, 1956—A. Pullen (Pat. Abs.) ... 404

Electrolytic Treatment of Metal Surfaces, No. 2,780,592, February 5, 1957—R. Wick (Pat. Abs.) ... 1001

Page

Electrolytic Treatment of Slide Fasteners—No. 2,790,756, April 30, 1957—C. Cohn (Pat. Abs.) ... 1206

Electrolytic Wire Reducing Apparatus—No. 2,784,154, March 5, 1957—A. Korbelak (Pat. Abs.) ... 1006

Electropolishing
Composition for Use in Electropolishing—No. 2,773,821, Dec. 11, 1956—G. Smith (Pat. Abs.) ... 666
Electrolytic and Chemical Polishing of Metals in Research and Industry, W. J. McG. Tegart (Books) ... 378
Electrolytic Burr Removal—No. 2,784,155, March 31, 1957—W. Heinrich (Pat. Abs.) ... 1006
Electrolytic Polishing—J. Bergere and R. Mondon (Art. Ref.) ... 804
Electrolytic Polishing of Metals—No. 2,757,136, July 31, 1956—Josef Heyes (Pat. Abs.) ... 188
Electrolytic Polishing of Metals, I. Hrivnak (Art. Ref.) ... 308
Electrolytic Polishing Solution—No. 2,762,766, September 11, 1956—Bo-Shin Ro (Pat. Abs.) ... 402
Electropolishing Apparatus—No. 2,782,160, February 19, 1957—M. Treuhaft and C. Swanson (Pat. Abs.) ... 1004
Electropolishing Inner Surfaces—No. 2,764,540, September 26, 1956—G. Nelson, P. Duddy and W. Farin (Pat. Abs.) ... 404
Electrostatic Application, E. S. Beck (Art. Ref.) ... 1125, 1226
Electrowinning of Copper—No. 2,792,342, May 14, 1957—S. Tuwinner (Pat. Abs.) ... 1208
Enameling Ground Coat—No. 2,786,782, March 26, 1957—H. Zimmerman, et al. (Pat. Abs.) ... 1102
Enameling Metals—No. 2,768,907, October 30, 1956—W. Lusby (Pat. Abs.) ... 514
Enameling, Preparation of Metal Sheet for—No. 2,774,678, Dec. 18, 1956—C. Rodman (Pat. Abs.) ... 666
Enameling Process, Vitreous—No. 2,768,904, October 30, 1956—A. Chester (Pat. Abs.) ... 514
Epoxy Resin Modified Phenol Resin Abrasive—No. 2,779,668, January 29, 1957—R. Daniels and A. Mostello (Pat. Abs.) ... 1000
Equipment and Supplies
Alignment Chart for Finding Weight and Area of Springs, G. C. Field ... 386
Apparatus for Burnishing Aluminum Die Castings—No. 2,758,372, August 14, 1956—C. Benedict (Pat. Abs.) ... 298
Apparatus for Electroplating Studies—No. 2,760,928, August 28, 1956—M. Cerea (Pat. Abs.) ... 302
Apparatus for Treatment with Solvents—No. 2,771,086, November 20, 1956—T. Kearney (Pat. Abs.) ... 188
Contact for Electroplating Machines—No. 2,762,772, September 11, 1956—W. Jackson (Pat. Abs.) ... 402
Electroplating Fixtures—No. 2,761,831, September 4, 1956—H. Luechauer (Pat. Abs.) ... 302
Factors to Consider in Selecting Automatic Spray Equipment, E. H. Cocks (Art. Ref.) ... 1126
Finishing Apparatus—No. 2,767,524, October 23, 1956—P. Schaffner (Pat. Abs.) ... 515
How to Select and Use Contact Wheels, W. K. Seward (Art Ref.) ... 1028
Know Stainless Steels when Selecting for Equipment, W. E. McFee (Art. Ref.) ... 308
Plating and Surface Finishing Facilities for a Machine Shop, C. C. Clayton (Art. Ref.) ... 1126
Plating Rack—No. 2,793,994, May 23, 1957—Joseph Novitsky (Pat. Abs.) ... 1211
Plating Machine—No. 2,789,569, April 23, 1957—John Davis (Pat. Abs.) ... 1127
Work Carrier Hook—No. 2,787,969, April 9, 1957—J. Davis (Pat. Abs.) ... 1103
Work Handling Apparatus for Treating Hollow Articles—No. 2,780,229, February 15, 1957—J. Davis (Pat. Abs.) ... 1001
Etching
Dimensional Etching—Its Application to Airframes, R. H. Andrew and J. L. Duvall ... 1186
Electrolytic Etching Process—No. 2,775,553, Dec. 25, 1956—G. Kahen (Pat. Abs.) ... 668
Etching—No. 2,763,536, September 18, 1956—J. Easley and H. Swayze (Pat. Abs.) ... 68
Etching Aluminum—No. 2,795,490, June 11, 1957—K. Newman, et al. (Pat. Abs.) ... 1211
Etching Aluminum—No. 2,796,334, June 18, 1957—D. Robinson (Pat. Abs.) ... 1232
Etching Aluminum and Its Alloys—No. 2,762,694, September 11, 1956—K. Newman (Pat. Abs.) ... 68
Surface Treatment and Finishing of Light Metals. Part XII-A. Plating on Aluminum—Chemical Etching Processes, S. Wernick and R. Pinner (Art. Ref.) ... 72

Page

Experiments Made to Develop An Organic Lacquer Resistant to White Fuming Nitric Acid, G. W. Grupp (Art. Ref.) ... 1125

F

Farber, H. L. and Blum, W.
Throwing Power in Chromium Plating, Summaries of Completed AES Research Projects ... 767
Feeley, W.
Registration Committee, Montreal Convention ... 408, 651
Ferguson, A. L.
Adhesion of Electrodeposits (Project No. 3), AES Research ... 494
Ferrous Metals—Part I, 1956 Supplement to ASTM Standard (Books) ... 252
Ferrous Parts with Copper, Impregnating—No. 2,778,742, January 22, 1957—P. Shipe (Pat. Abs.) ... 912
Ferrous Surfaces, Method of Treating—No. 2,759,862, August 21, 1956—J. Hendricks (Pat. Abs.) ... 300
Field, G. C.
Alignment Chart for Finding Weight and Area of Springs ... 386
Biography ... 387
Filamentary Growths on Copper Cathodes, T. C. J. Ovenston, C. A. Parker and A. E. Robinson (Art. Ref.) ... 1328
Films, Apparatus for Production of Electrically Resistant—No. 2,790,731, April 30, 1957—B. Ostrofsky and J. Ballard (Pat. Abs.) ... 1206
Films, Method of Making Transparent Conducting—No. 2,769,778, Nov. 6, 1956—J. Preston (Pat. Abs.) ... 662
Filter, What Size?, Gunnar Gabrielson (Art. Ref.) ... 1028
Financial Report—Fiscal Year ended March 31, 1957 ... 778
Financing AES Research, A. P. Wrisberg, Vice Chairman, Finance ... 490
Finishes Tested by Sun and Weather, E. A. Blount (Art. Ref.) ... 72
Fluoborates, Preparation of Metal—No. 2,772,228, November 27, 1956—A. McElroy and R. Hunt (Pat. Abs.) ... 402
Foran, N.
The Plater's Art in Printed Circuitry ... 1071
Biography ... 1078
Foulke, Dr. D. G.
Biography ... 863
Patent Abstracts ... 68, 188, 298, 402, 514, 662, 789, 912, 1000, 1100, 1206, 1314
Foulke, D. G. and C. F. Gurnham
Bibliography on Metal Finishing Wastes, Wastes, 1955 ... 688
Bibliography on Metal Finishing Wastes, 1956 ... 916
Foulke, Dr. D. G. and Dr. O. Kardos
Current Distribution on Microprofiles, Carl Heussner Award—44th Annual Convention ... 783
Foulke, Dr. D. G. and D. Milne
Water . . . A Global Problem for Electroplaters ... 859
Friedt, G. H. Jr.
Meet Mr. President ... 996
Fringe Benefits, C. Kelly (Editorial) ... 123
Frost, A. A.
Hotel Committee, Montreal Convention ... 408, 651
Fuchsin in Bright Nickel Deposits, Inclusion of, J. L. Dye and O. J. Klingenmaier (Art. Ref.) ... 804
Fume Exhaustion in the Plating and Allied Industries, D. J. Fishlock (Art. Ref.) ... 906
Fundamental Studies on the Adhesion of Organic Materials to Metal Substrates, R. L. Patrick and W. A. Vaughan (Books) ... 1027
Further Studies of an Electronic Thickness Gage, F. P. Brodell and A. Brenner ... 591

G

Gallium, Recovering—No. 2,793,179, May 21, 1957—P. de la Breteque (Pat. Abs.) ... 1208
Galvanizing Composition—No. 2,793,965, May 28, 1957—H. Myers and O. Proelss (Pat. Abs.) ... 1210
Gas
Chemical Polishing of V2A-Steel with Gases, G. Schmid, E. Maurer and H. Steinhausen (Art. Ref.) ... 308
Dissolved Gases in Plating Baths, W. M. Tucker and F. O. Beuckman, George B. Hogaboom Memorial Award—44th Annual Convention ... 783
Gas Plating—No. 2,763,576, September 18, 1956—H. Belitz and O. Davis (Pat. Abs.) ... 68
Gas Plating Process—No. 2,785,997, March 19, 1957—P. Marvin (Pat. Abs.) ... 1101
Gas Plating—No. 2,793,140, May 21, 1957 B. Ostrofsky and J. Ballard (Pat. Abs.) ... 1208
Metal Deposits from Gases, C. F. Gurnham (Art. Ref.) ... 72, 194
Permeation of Gases Through Electrolytic Nickel Deposits. II. Determination of the Effect of Several Variables

on the Intrinsic Permeability of Nickel Deposits to Gases, D. T. Ewing and J. M. Tobin (Art. Ref.) ... 194
George B. Hogaboom Memorial Award, Dissolved Gases in Plating Baths, W. M. Tucker and F. O. Beuckman, Honored at the Society's 44th Annual Convention ... 783
Gerada, A. J.
(Athletic), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Germanium Rectifiers for Electroplating, Protection of, S. P. Jackson (Art. Ref.) ... 414
Gilbert, L. O.
Candidates for National Third Vice President ... 426
Glasrud, C. J.
Role of Modern Barrel Finishing, The ... 47
Biography ... 51
Glass Fiber, Metal Coated—No. 2,791,515, May 7, 1957—H. Nack (Pat. Abs.) ... 1206
Glover, G. E.
Economics of Treatment of Strong Chromic Acid Solutions, The ... 161
Biography ... 165
Glover, M.
Law Committee, Chairmen of 1957–1958 AES Boards and Committees ... 985
Glover, W.
Program Committee, Montreal Convention ... 408, 651
Gold-Silver Alloy Plating, Dr. R. E. Harr and A. G. Cafferty, Precious Metal Plating Award—44th Annual Convention ... 783
Gough, C. L.
Biography ... 883
Gough, C. L. and C. G. Buehtman
Operating Experiences with Chromic Acid Recovery Equipment ... 879
Grid Bearing—No. 2,770,586, Nov. 13, 1956—E. Davis (Pat. Abs.) ... 662
Grinding Composition—No. 2,783,137, February 26, 1957—H. Roth (Pat. Abs.) ... 1004
Grit Blasting: An Aid to Carburizing Quality, A. J. Schwarzkopf (Art. Ref.) ... 308
Gun Bores, Chromium Plating of, V. A. Lamb and J. P. Young, Chromium Plating Award—44th Annual Convention ... 783
Gurnham, C. F.
Current Trends in Plating Waste Abatement ... 873
Biography ... 878
Gurnham, C. F. and D. G. Foulke
Bibliography on Metal Finishing Wastes, 1955 ... 688
Bibliography on Metal Finishing Wastes, 1956 ... 916

H

Hard Surfacing Metals—No. 2,800,419, July 23, 1957—H. Kough (Pat. Abs.) ... 1317
Harr, Dr. R. E. and A. G. Cafferty
Gold-Silver Alloy Plating, Precious Metal Award—44th Annual Convention ... 783
Head, H. E.
Educational Committee, Chairman of 1957–1958 AES Boards and Committees ... 985
Live and Learn (Editorial) ... 947
1957–1958 National Officers, 1st Vice President, AES ... 777
Second Vice President's Report ... 628
Heat Resistant Paints for Rocket Launchers, T. Rice (Art. Ref.) ... 1329
Heiman, Dr. S.
The Industry, the AES and the Future (Editorial) ... 563
1957–1958 National Officers, Past President, AES ... 777
President's Report ... 623
Hemmendinger, H.
Biography ... 278
Hemmendinger, H. and H. B. Davidson
Color Difference Specifications ... 274
Heroux, R. R.
Meet Mr. President, Springfield Branch ... 200
Hetz, G. J.
Co-Chairman, Los Angeles 1960 Convention and Exposition Chairmen and Co-Chairmen ... 985
Hill, E. A.
Biography ... 868
Hill, E. A. and F. J. Neff
Cyanide Waste—Oxidized in the Plating Room ... 864
Hopewell, L. H.
Mechanical Finishing of Precision Parts ... 36
Biography ... 39
Mechanical Finishing of Precision Parts, Robert S. Leather Award—44th Annual Convention ... 783
How Design Affects Cost of Chrome-Plated Die-Castings, D. H. Robinson (Art. Ref.) ... 1125
How to Determine a "Comparable Cost" for Paints, V. B. Volkening and J. T. Wilson (Art. Ref.) ... 1226
How to Get More for Your Metalworking Dollar (Art. Ref.) ... 692
Howald, L. J.
(Publicity), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Hypo Solutions, Apparatus for Rejuvenating—No. 2,791,556, May 7, 1957—G. Duisenberg (Pat. Abs.) ... 1206

I

Increased Production at Lower Cost Through Automation ... 1306
Increasing Polishing Efficiency (Russian), D. V. Charnko and L. V. Khadobin (Art. Ref.) ... 1328
Industrial Water and Industrial Waste Water, ASTM Special Technical Publication No. 207 (Books) ... 1116
Industry, the AES and the Future, S. Heiman (Editorial) ... 563
Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating (Project No. 14), M. H. Jones, AES Research ... 501
Influence of Some Process Variables on the Reflectivity and Surface Appearance of Electrolytic Tinplate The, R. Mills (Art. Ref.) ... 309
Institute of Metal Finishing: 1957 Annual Conference (Art. Ref.) ... 1029
Institute of Metal Finishing Prizewinning Plating Plant Layouts ... 1086
Insulators, Conductive Coatings—No. 2,788,297, April 9, 1957—A. Louis (Pat. Abs.) ... 1127
Insulator with Multiplicity of Conducting Elements—No. 2,793,178—C. Morris (Pat. Abs.) ... 1208
Intaglio Printing Cylinders, Making—No. 2,776,256, January 1, 1957—K. Eutner and J. Mueller (Pat. Abs.) ... 789
Interim Meeting—Pittsburgh ... 34, 192
Interim Meeting Reporter—Fifth Interim Meeting, Indianapolis, January 11 ... 1153, 1285
Ion Exchange in a Modern Nickel-Chromium Plating Plant (Art. Ref.) ... 804

J

Joining High Temperature Melting Point Metals—No. 2,795,040, June 11, 1957—D. Antel, et al. (Pat. Abs.) ... 1211
Jones, M. H.
Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating (Project No. 14), AES Research ... 501

K

Kahan, G. J.
The Effect of Surface Finishing of Nonferrous Base Metals on the Protective Value of Plated Coatings (Project No. 4), AES Research ... 495
Kahler, H. A.
Biography ... 160
Kahler, H. A. and C. F. Nixon
Anodized Aluminum for Automobile Trim Parts ... 156
Kane, Dr. J.
Educational Co-Chairman, Montreal Convention ... 651
"Kanigen" Chemical Nickel Plating, G. Gutzeit and E. T. Mapp (Art. Ref.) ... 72
Kanigen Process, Influence of Heat Treatment on the Properties of Chemical Nickel Coatings Produced by the, Edward Heinzelman Jr. ... 805
Kaplan, D
(Secretary), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Kardos, Dr. O. and Dr. D. G. Foulke
Current Distribution on Microprofiles, Carl Heussner Award—44th Annual Convention ... 783
Kellner, H. L.
Chairman, Fourth Session, Montreal Convention ... 519, 649
Paper Awards Committee, Chairmen of 1957–1958 AES Boards and Committees ... 985
Kelly, B. T.
Banquet Committee, Montreal Convention ... 408, 651
Kelly, C.
Fringe Benefits (Editorial) ... 123
Mechanical Finishing of Metal Surfaces (Project No. 18), AES Research ... 509
Past President's Report ... 629
Kinetics of Metal Deposition, Significance of Experimental Data and Some Results Using Volt-Ammetry at Constant Current, T. Pavlopoulos and J. D. H. Strickland (Art. Ref.) ... 1226
Knotowicz, A. E.
Biography ... 606
Knotowicz, A. E. and J. V. Petrocelli
The Polarographic Analysis of Tin and Tin Alloy Plating Solutions ... 602
Kronsbein, J.
Current and Metal Distribution in Electrodeposition (Project No. 11), AES Research ... 498

L

Lamb, V. A. and J. P. Young
Chromium Plating of Gun Bores, Chromium Plating Award—44th Annual Convention ... 783
Lead-Tin Alloy Plating for Aircraft Engine Components, J. Azzolino ... 1180
Leffler, E. B.
Biography ... 396
Leffler, E. B. and H. Leidheiser Jr.
Microthrowing Power, A Literature Search, AES Research Project No. 17 ... 388
Leftin, J. P.
Photometric Determination of Molybdenum in Zinc Cyanide Plating Solutions ... 380
Biography ... 382
Leidheiser, H., Jr.
Biography ... 396
Leidheiser, H. Jr. and E. B. Leffler
Microthrowing Power, A Literature Search, AES Research Project No. 17 ... 388
Leveling During Electrodeposition of Nickel in the Presence of Organic Compounds, The Mechanism of, H. Leidheiser Jr. (Art. Ref.) ... 196
Linford, H. B.
Cleaning and Preparation of Metals for Electroplating (Project No. 12), AES Research ... 507
Live and Learn, H. E. Head (Editorial) ... 947
Long, S. A.
Vital Role of Plating and Pickling Techniques in the Aircraft Industry, The ... 1183
Biography ... 1185
Long, T. F.
Polyvinyl Chloride Pipe Handles Corrosive Plating Solutions ... 975
Biography ... 978
Loveless, W. W.
(Hotel), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Low-Cost Integrated Waste Treatment at American Sterilizer, J. Stroh and C. Allen ... 869
Lowneheim, F. A.
Over-all Summary, Projects 2, 16 and 17, AES Research ... 503
Lux, G. A., W. Blum
Methods of Polishing Steel and Their Effects Upon the Protective Value of Electroplated Coatings, Summaries of Completed AES Research Projects ... 770

M

Magnetic Materials—No. 2,792,340, May 14, 1957—J. James (Pat. Abs.) ... 1206
Maintenance of Electrical Equipment in the Plating Room, J. F. Day (Art. Ref.) ... 1328
Manganese, Electrodepositing—No. 2,798,038, July 2, 1957—R. Dean (Pat. Abs.) ... 1315
Manganese, Production of—No. 2,766,197, October 9, 1956—M. Carosella (Pat. Abs.) ... 514
Marcovitch, I. Wm.
Plating on Aluminum Bronze ... 387
Mathers, F. C.
Stripping of Copper from Various Base Metals (Project No. 1), AES Research ... 493
McAleer, H. J.
Chairman, Detroit Exposition 1959, Convention and Exposition Chairmen and Co-Chairmen ... 985
McTague, R. F.
Development of Plastisol Systems for the Metal Coating Industry ... 263
Biography ... 265
Mechanical Finishing of Metal Surfaces (Project No. 18), C. Kelly, AES Research ... 509
Mechanical Finishing of Precision Parts, L. H. Hopewell ... 36
Mechanical Finishing of Precision Parts, L. H. Hopewell, The Robert S. Leather Award—44th Annual Convention ... 783
Mechanism of Electrodeposition (Project No. 16), J. O'M. Bockris, AES Research ... 505
Meet Mr. President
Dent, M. H. Maimi Branch ... 1326
Friedt, G. H. Jr., Detroit Branch ... 996
Heroux, R. R., Springfield Branch ... 200
Voyda, T., Waterbury Branch ... 66
Mendels, B.
Finance Committee, Montreal Convention ... 408, 651
Mendizza, A.
Standard Salt-Spray Test—Is It a Valid Acceptance Test? ... 166
Messenger, R. G.
Biography ... 42
Messenger, R. G. and C. B. Schaefer
Barrel Finishing with Steel Balls and Shapes ... 40
Metal Finishing Suppliers' Association Program ... 650
Metal Finishing Wastes, Bibliography on (1955), C. F. Gurnham D. G. Foulke ... 688
Metal Finishing Wastes, Bibliography on (1956), C. F. Gurnham D. G. Foulke ... 916
Metal Surface Treatment Conference (Art. Ref.) ... 72
Metallic Surfaces Research, R. L. Samuel (Art. Ref.) ... 1329

Page

Metallographic Study of Electroplated Coatings of Chromium and Nickel on Molybdenum, R. J. Runck (Art. Ref.) ... 692
Metallography as an Aid to Electrodeposition, A. Comley (Art. Ref.) ... 72
Method for Determining the Electrical Resistance of Phosphate Coatings on Steel, A. J. W. Scott and L. L. Shreir (Art. Ref.) ... 1226
Method for Electroforming a Copper Article—No. 2,762,762, September 11, 1956—D. Donahue (Pat. Abs.) ... 402
Method for Producing Paint Bonding Felons on Ferriferous Metal Surfaces—No. 2,762,731, September 11, 1956—F. Heller and F. Sprunce Jr. (Pat. Abs.) ... 304
Methods for Testing Thickness of Electrodeposits (Project No. 7), H. J. Read, AES Research ... 496
Method for Producing Perforated Metal Webs—No. 2,762,149, September 11, 1956—N. Mears (Pat. Abs.) ... 304
Method for use in Treating and Deforming Metals—No. 2,767,11, October 16, 1956—G. Otto and H. Faigen (Pat. Abs.) ... 515
Method of Forming Internally Flanged Structures—No. 2,761,828, September 4, 1956—A. Eldridge and E. Ginzton (Pat. Abs.) ... 302
Method of Making Silver Mirrors—No. 2,762,714, September 11, 1956—E. Smith and J. Fitzgerald (Pat. Abs.) ... 304
Method of Preparing Magnesium for Reception of Nickel Electroplate—No. 2,774,683, Dec. 18, 1956—H. K. DeLong ... 666
Method of Removing Scale from Ferrous Workpieces—No. 2,762,729, September 11, 1956—R. Snow (Pat. Abs.) ... 304
Microprofiles, Current Distribution on, Dr. D. G. Foulke and Dr. O. Kardos, Carl Heussner Award—4th Annual Convention ... 783
Microthrowing Power, A Literature Search, AES Research Project No. 17, E. B. Leffler and H. Leidheiser Jr. ... 388
Miller, Mrs. R. D. (Ladies), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Miller, R. D. (Educational), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Milne, D. Biography ... 863
Milne, D. and Dr. D. G. Foulke Water . . . A Global Problem for Electroplaters ... 859
Milwaukee Deals with the Allied Arts, L. Diveley ... 306
Mirrographic Finishing (Silk Screening), J. Starr (Art. Ref.) ... 1328

N

Nace Technical Committee Report, A. E. Schuetz and W. D. Robertson (Art. Ref.) ... 1125
Nace Technical Committee Report. Nace Technical Unit Committee T-1J on Oil Field Structural Plastics, W. B. Sanford (Art. Ref.) ... 1125
National Association of Metal Finishers Program ... 650
Nature, Cause and Effect of the Porosity in Electrodeposits, Project No. 13, AES Research, F. Ogburn ... 508
Nature of Mechanically Polished Metal Surfaces: The Surface Deformation Produced by the Abrasion and Polishing of 70:30 Brass, L. E. Samuels (Art. Ref.) ... 194
Nature of Some Mechanically Polished Metal Surfaces as Evidenced by Epitaxial Phenomena, L. E. Samuels (Art. Ref.) ... 692
Naval Research Laboratory Report—Excerpts
Effect of Baking on Delayed Fracture of Electroplated Ultra High-Strength Steel, D. F. Brown ... 1114
Neben, E. W.
Stop Chrome Waste, Pollution and Heat Loss ... 52
Biography ... 55
Neff, F. J.
Biography ... 868
Neff, F. J. and E. A. Hill
Cyanide Waste—Oxidized in the Plating Room ... 864
New Developments in the Field of Organic Coatings, R. F. Ames ... 266
Nichols, J. P.
Answer Lies With You, The (Editorial) ... 351
Editorial Board, Chairmen of 1957–1958 AES Boards and Committees ... 985
Executive Secretary, AES, 1957–1958 National Officers ... 777
Executive Secretary's Report ... 630
This Message to You at Christmastime (Editorial) ... 1263
What Constitutes a State? (Editorial) ... 739
Nickel
Alkaline Nickel Plating Solution—No. 2,773,818, Dec. 11, 1956—A. DuRose et al (Pat. Abs.) ... 664
Bright Nickel Plating in the Costume Jewelry Industry, E. N. Castellano ... 1083
Bright Nickel Plating on Cast Iron, E. Alary (Art. Ref.) ... 1125
Chemical Nickel Plating Process—No. 2,772,183, Nov. 27, 1956—P. Talmey et al (Pat. Abs.) ... 664

Page

Conservation of Nickel in Electroplating, V. L. McEnally Jr. and F. J. Brune (Art. Ref.) ... 194
Electrodeposition of Nickel—No. 2,757,133—July 31, 1956—W. Shenk Jr. (Pat. Abs.) ... 188
Electrodeposition of Nickel—No. 2,781,305, February 12, 1956—H. Brown (Pat. Abs.) ... 1002
Electrodeposition of Nickel—No. 2,781,306, February 12, 1957—H. Brown (Pat. Abs.) ... 1002
Electrodeposition of Nickel—No. 2,782,152, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) ... 1002
Electrodeposition of Nickel—No. 2,782,153, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) ... 1003
Electrodeposition of Nickel—No. 2,782,154, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) ... 1003
Electrodeposition of Nickel—No. 2,784,152, March 12, 1957—D. Ellis (Pat. Abs.) ... 1005
Electrodeposition of Nickel—No. 2,795,540, 6/11/57—H. Brown (Pat. Abs.) ... 1232
Electroless Nickel Plating for Making Ohmic Contacts to Silicon, Miles V. Sullivan and John H. Eigler (Art. Ref.) ... 906
Finishing Nickel and High Nickel Alloys, L. F. Spencer (Art. Ref.) ... 692
"Kanigen" Chemical Nickel Plating, G. Gutzeit and E. T. Mapp (Art. Ref.) ... 72
Limitations of Plated Nickel in Jet Engine Design, R. W. Moeller and W. A. Snell, (Art. Ref.) ... 692
Nickel and Chromium Plating on Steel, Protective Value of (Concluded 1934), Summaries of Completed AES Projects, W. Blum, P. W. Strausser, A. Brenner ... 768
Nickel Outlook Good: Signs Point to End of Famine, F. J. Starin (Art. Ref.) ... 1125
Nickel Will Stretch, C. F. Nixon ... 757
Nickel Plating by Chemical Reduction—No. 2,774,688, Dec. 18, 1956—R. Girard (Pat. Abs.) ... 666
Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals (Concluded 1940), Summaries of Completed AES Research Projects, W. Blum and P. W. Strausser ... 770
Structure of Chemically Deposited Nickel, A. W. Goldenstein, W. Rostoker and F. Schossberger (Art. Ref.) ... 690
Studies on Electroless Nickel Plating, A. Brenner and C. H. de Minjer ... 1297
Nitriding Stop-off—No. 2,788,302, April 9, 1957—J. Drew (Pat. Abs.) ... 1127
Nixon, C. F.
Chairman, First Session, Montreal Convention ... 518, 649
Nickel Will Stretch ... 757
Over-All Summary, Projects 5, 14 and 15, AES Research ... 499
Biography ... 160, 762
Nixon, C. F. and H. A. Kahler, Anodized Aluminum for Automobile Trim Parts ... 156
Nondestructive Thickness Measurement of Anodizing Using the Interference Microscope, R. L. Saur ... 1079
Non-Ferrous Metals—Part 2, 1956 Supplement to ASTM Standards (Books) ... 252
Nowacki, L. J.
Organic Coatings in Metal Finishing ... 269
Biography ... 273

O

Ogburn, F.
Nature, Cause and Effect of the Porosity in Electrodeposits, Project No. 13, AES Research ... 508
Operating Experiences with Chromic Acid Recovery Equipment, C. F. Gough and C. G. Buehtman ... 879
Organic Coatings in Metal Finishing, L. J. Nowacki ... 269
Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Nonferrous Metals (Concluded 1940), Summaries of Completed AES Research Projects, W. Blum and P. W. Strausser ... 770

P

Paint Application Methods, A Survey of, E. A. Blount (Art. Ref.) ... 1125
Painting and the Plater, M. Borushko ... 260
Patent Abstracts
Dr. D. G. Foulke ... 68, 188, 298, 402, 514, 662, 789, 912, 1009, 1109, 1206, 1314
Pearl Essence—Aqueous Dispersions, W. E. Decker (Art. Ref.) ... 1328
Petrocelli, J. V. and A. E. Knotowicz
The Polarographic Analysis of Tin and Tin Alloy Plating Solutions ... 602
Biography ... 606
Physical Properties of Electrodeposited Metals—Nickel, Project No. 9, A. Brenner, AES Research ... 497
Physical Properties of Electrodeposited Metals, T. E. Such (Art. Ref.) ... 1329

Page

Pickling
Electrolytic Pickling Apparatus—No. 2,758,888, August 21, 1956—G. Rendel (Pat. Abs.) ... 302
Regeneration of Pickling Liquor—No. 2,785,957, March 19, 1957—D. Ruthner (Pat. Abs.) ... 1101
Steel Pickling Process—No. 2,762,728, September 11, 1956—E. Hahn (Pat. Abs.) ... 304
Vital Role of Plating and Pickling Techniques in the Aircraft Industry, The, S. A. Long ... 1183
"Pinholing" of Light Gauge Aluminum Cooking Utensils, An Explanation of, P. M. Aziz (Art. Ref.) ... 1226
Pinner, W. L.
Accelerated Corrosion Tests for the Performance of Plated Coatings (Fourth Progress Report) ... 763
Biography ... 763
Accelerated Corrosion Tests, Project No. 15, AES Research ... 502
Chairman, Second Session, Montreal Convention ... 518, 649
Pitting and Cracking, U. R. Evans (Art. Ref.) ... 308
Plastics
Design and Engineering of Plastic Materials of Construction, O. H. Fenner and R. F. Whittier (Art. Ref.) ... 194
How Plastics Curb Corrosion in Metal Processing, J. H. Lux (Art. Ref.) ... 308
Organic Corrosion With Special Reference to Synthetic Plastic Materials (Art. Ref.) ... 194
Plastic Articles and Method of Making—No. 2,768,133, October 23, 1956—A. Lundbye (Pat. Abs.) ... 514
Plastics, R. B. Seymour (Art. Ref.) ... 1226
Plastics-Based Strippable Coatings, E. S. Lower and S. Cressey (Art. Ref.) ... 906
Plater's Art in Printed Circuitry, The, N. Foran ... 1071
Platers in Montreal at Convention Time ... 784, 785
Plating
Alkali Metal Phosphate Coating Solutions—No. 2,758,949, August 14, 1956—H. Ley, et. al. (Pat. Abs.) ... 298
Anode and Method of Continuous Plating—No. 2,776,929, January 8, 1957—E. Newton (Pat. Abs.) ... 790
Development of Plastisol Systems for the Metal Coating Industry, R. F. McTague ... 263
Alloys
Black Chromium-Nickel-Vanadium-Electrodeposits—No. 2,739,109, March 20, 1956—M. Quaely (Pat. Abs.) ... 68
Cadmium-Tin and Zinc-Tin Alloy Electrodeposits, A Study of, B. Cohen ... 963
Electrodeposition from Sulphamate Solutions—Part III. Nickel-Zinc Alloys, S. Sathyanarayn and T. L. Rama Char, (Art. Ref.) ... 906
Electrodeposition of Copper-Tin Alloys—No. 2,793,990, 5/28/57—E. Heymann and G. Schmerling (Pat. Abs.) ... 1210
Electrodeposition of Iron-Zinc Alloys—No. 2,778,787, January 22, 1957—F. Salt (Pat. Abs.) ... 912
Electrodeposition of Metals from Organic Solutions. III. Preparation and Electrolysis of Titanium and Zirconium Compounds in Nonaqueous Media, W. E. Reid Jr., J. M. Bish and A. Brenner (Art. Ref.) ... 412
Electroless Arsenic-Zinc Alloy, H. J. West (Art. Ref.) ... 308
Electroplating Chromium-Nickel Alloy Coatings—No. 2,739,108, March 20, 1956—M. Quaely (Pat. Abs.) ... 68
Electroplating on Titanium Alloys, L. Missel (Art. Ref.) ... 1226
Gold-Silver Alloy Plating, Dr. R. E. Harr and A. G. Cafferty, Precious Metal Plating Award—44th Annual Convention ... 783
Hardness of Electrodeposited Tin-Nickel Alloy on Brass, V. R. Ramanathan (Art. Ref.) ... 308
How Rheem Automotive Company Plates Bumpers (Art. Ref.) ... 906
Lead-Tin Alloy Plating for Aircraft Engine Components, J. Azzolino ... 1180
Plating on Aluminum Bronze, I. Wm. Marcovitch ... 387
Process for the Electrodeposition of Iron-Chromium Alloys—No. 2,766,196, October 9, 1956—T. Yoshida (Pat. Abs.) ... 514
Study of Cadmium-Tin and Zinc-Tin Alloy Electrodeposits, B. Cohen ... 963
Aluminum
Coating Ferrous Metals with Aluminum—No. 2,785,084, March 12, 1957—H. Lundin (Pat. Abs.) ... 1006
Electroplating Aluminum—No. 2,791,553, 5/7/57—T. J. Conner and R. Blumberg (Pat. Abs.) ... 1206
Electrodepositing Aluminum—No. 2,763,605, September 18, 1956—M. Miller and C. Baker (Pat. Abs.) ... 68

Page

Electrodeposition of Metals from Organic Solutions. II. Further Studies on the Electrodeposition of Aluminum from a Hydride Bath, J. H. Connor and A. Brenner (Art. Ref.) 194

Method for Electroplating Aluminum—No. 2,762,763, September 11, 1956—C. Diven (Pat. Abs.) 402

Surface Treatment and Finishing of Light Metals, Part XII-D. Plating on Aluminum—The Vogt Process (Art. Ref.) 906

Antimony Plating Bath—No. 2,779,725, January 27, 1957—C. Smart (Pat. Abs.) 1000

Automatic Plating Current Control System—No. 2,757,137, July 31, 1956—J. Petrovich and D. Leedy (Pat. Abs.) 188

Automatic Plating of Zinc Die Castings, E. W. Horvick (Art. Ref.) 309

Beryllium Electroplating—No. 2,798,036, 7/2/57—J. Utz (Pat. Abs.) 1315

Beryllium, Electroplating on, J. G. Beach and C. L. Faust (Art. Ref.) 308

Brass Plating, Modern, H. Strow (Art. Ref.) 692

Bright Nickel Plating in the Costume Jewelry Industry, E. N. Castellano 1083

Bright Plating—No. 2,800,439, 7/23/57—J. Fischer, et al (Pat. Abs.) 1317

Cadmium, Deposition of, by Chemical Reduction—No. 2,790,733, 4/30/57—D. Couch (Pat. Abs.) 1206

Chromium

Chromium Plate Irregular Surfaces Uniformly, L. Rosenberg (Art. Ref.) 72

Chromium Plating, D. J. Fishlock (Art. Ref.) 194

Chromium Plating—No. 2,787,588, April 2, 1957—J. Stareck (Pat. Abs.) 1102

Chromium Plating—No. 2,787,589, April 2, 1957—J. Stareck (Pat. Abs.) 1103

Chromium Plating—No. 2,800,436, 7/23/57—J. Stareck and E. Seyb (Pat. Abs.) 1317

Chromium Plating from the Trivalent Bath, M. R. Zell (Art. Ref.) 308

Chromium Plating Over a Chromate Film. A Preliminary Study, J. E. Hoover (Art. Ref.) 308

Diffusion Chromium Coating Steel Surfaces—No. 2,791,517, 5/7/57—G. Becker and F. Steinberg (Pat. Abs.) 1206

Electrodeposition of Chromium—No. 2,771,413, November 20, 1956—R. Dean (Pat. Abs.) 402

Electrodeposition of Chromium—No. 2,784,153, March 5, 1957—A. DuRose (Pat. Abs.) 1005

Investigation of Chromium Plating Baths of the Combined Type, N. T. Drobantseva and A. N. Sysoev (Art. Ref.) 194

Method of Plating Chromium over Antimony—No. 2,764,538, September 25, 1956—C. Smart (Pat. Abs.) 404

Nickel and Chromium Plating on Steel, Protective Value of (Concluded 1934), Summaries of Completed AES Projects, W. Blum, P. W. Strasser, A. Brenner 768

Repair of Car Parts by Chromium Plating, A. W. Rykowa (Art. Ref.) 804

Surface Treatment and Finishing of Light Metals. Part XII-C. Plating on Aluminum-Zinc Immersion Processes, S. Wernick and R. Pinner (Art. Ref.) 412

Throwing Power in Chromium Plating (Concluded 1929), Summaries of Completed AES Research Projects, Associates H. L. Farber and W. Blum—National Bureau of Standards 767

Copper

Acid Copper Plating—No. 2,799,634, 7/16/57—R. Woehrle and J. Condon (Pat. Abs.) 1316

Addition Agent for Copper Plating—No. 2,774,728, Dec. 18, 1956—C. Wernlund (Pat. Abs.) 668

Bath for Plating Bright Copper—No. 2,770,587, Nov. 13, 1956—B. Ostrow (Pat. Abs.) 662

Bright Acid Copper Plating—No. 2,758,076, August 7, 1956—F. Passal (Pat. Abs.) 298

High Speed Copper Cyanide Plating—No. 2,765,117, March 12, 1957—M. Ceresa and R. Woehrle (Pat. Abs.) 1100

Method and Apparatus for Depositing Copper—No. 2,748,024, May 29, 1956—M. Meth (Pat. Abs.) 68

Courses in Electroplating 901

Decorative Metal Plating—No. 2,780,591, February 5, 1957—S. Frey (Pat. Abs.) 1001

Electrodepositing Baths—No. 2,763,606, September 18, 1956—W. Hespenheide and C. Faust (Pat. Abs.) 68

Electrodeposition—No. 2,784,151, March 5, 1957—P. Topelian (Pat. Abs.) 1005

Page

Electrodeposition Method—No. 2,768,774, Nov. 6, 1956—T. Loveland and A. Prust (Pat. Abs.) 662

Electrodeposition of Metals from Organic Solutions. IV. Electrodeposition of Beryllium and Beryllium Alloys, G. B. Wood and A. Brenner (Art. Ref.) 412

Electrodeposition of Metals from Organic Solutions. V. Electrodeposition of Magnesium and Magnesium Alloys, J. H. Connor, W. E. Reid Jr. and G. B. Wood (Art. Ref.) 412

Electrodeposition of Metals from Organic Solutions. I. General Survey, A. Brenner (Art. Ref.) 194

Electroless Plating—No. 2,791,516, 5/7/57—C. Chambers and R. Spaulding (Pat. Abs.) 1206

Electroplating Bath Purification—No. 2,787,590, April 2, 1957—E. Rinker (Pat. Abs.) 1103

Electroplating Baths for Ultra-High Strength Steels. Part I—Use of Aliphatic Amino Acids in Cadmium Baths to Reduce Hydrogen Embrittlement, P. N. Vlannes, S. W. Strauss, and B. F. Brown 1027

Electroplating, Courses in 901

Electroplating From Organic Solutions (National Bureau of Standards) (Art. Ref.) 1226

Electroplating is an Important Step in the Construction of a Man-Made Satellite, George W. Grupp (Art. Ref.) 1028

Electroplating Method—No. 2,783,193, February 26, 1957—T. Nietor (Pat. Abs.) 1004

Electroplating, Method of—No. 2,758,962, August 14, 1956—H. Luechauer (Pat. Abs.) 300

Gold

Bath for Plating Bright Gold—No. 2,765,269, October 2, 1956—B. Ostrow and F. Nobel (Pat. Abs.) 404

Bright Gold Plating—No. 2,799,633, 7/16/57—E. Rinker (Pat. Abs.) 1316

Ferrocyanide Electrolytes for Gold Plating, V. L. Kheifets and E. I. Antonovskaya (Art. Ref.) 196

Hard-Gold Plating, N. P. Fedot'ev, N. M. Ostroumova and P. M. Vyacheslavov (Art. Ref.) 196

Gas Plating—No. 2,763,576, September 18, 1956—H. Belitz and O. Davis (Pat. Abs.) 68

Lead, Electrodeposition of—No. 2,773,819, Dec. 11, 1956—L. Gianelos (Pat. Abs.) 664

Lead from the Pyrophosphate Bath, Electrodeposition of, J. Vaid and T. L. Rama Char (Art. Ref.) 1028

Manganese, Electrodepositing—No. 2,798,038, 7/2/57—R. Dean (Pat. Abs.) 1315

Manganese, Production of—No. 2,766,197, October 9, 1956—M. Carosella (Pat. Abs.) 514

Method of Making Formed Plated Articles—No. 2,776,255, January 1, 1957—M. Hammond and G. Bowman (Pat. Abs.) 789

New Developments in the Field of Organic Coatings, B. F. Ames 266

New Plating and Polishing Department at Rank Precision Industries, Mitcheldean (Art. Ref.) 1126

Nickel

Alkaline Nickel Plating Solution—No. 2,773,818, December 11, 1956—A. DuRose et al (Pat. Abs.) 664

Bright Nickel Plating in the Costume Jewelry Industry, E. N. Castellano 1083

Bright Nickel Plating on Cast Iron, E. Alary (Art. Ref.) 1125

Chemical Nickel Plating—No. 2,766,138, October 9, 1956—P. Talmey (Pat. Abs.) 188

Chemical Nickel Plating Process—No. 2,772,183, November 27, 1956—P. Talmey et al (Pat. Abs.) 664

Conservation of Nickel in Electroplating, V. L. McEnally Jr. and F. J. Brune (Art. Ref.) 194

Electrodeposition of Nickel—No. 2,757,133, July 31, 1956—W. Shenk Jr. (Pat. Abs.) 188

Electrodeposition of Nickel—No. 2,781,305, February 12, 1956—H. Brown (Pat. Abs.) 1002

Electrodeposition of Nickel—No. 2,781,306, February 12, 1957—H. Brown (Pat. Abs.) 1002

Electrodeposition of Nickel—No. 2,782,152, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) 1002

Electrodeposition of Nickel—No. 2,782,153, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) 1003

Electrodeposition of Nickel—No. 2,782,154, February 19, 1957—A. DuRose and J. Little (Pat. Abs.) 1003

Electrodeposition of Nickel—No. 2,784,152, March 12, 1957—D. Ellis (Pat. Abs.) 1005

Page

Electrodeposition of Nickel—No. 2,795,540, 6/11/57—H. Brown (Pat. Abs.) 1232

"Kanigen" Chemical Nickel Plating, G. Gutzeit and E. T. Mapp (Art. Ref.) 72

Nickel and Chromium Plating on Steel, Protective Value of (Concluded 1934), Summaries of Completed AES Projects, W. Blum, P. W. Strasser, A. Brenner 768

Nickel Plating by Chemical Reduction—No. 2,774,688, Dec. 18, 1956—R. Girard (Pat. Abs.) 666

Studies on Electroless Nickel Plating, A. Brenner and C. H. de Minjer 1297

Organic Coatings in Metal Finishing, L. J. Nowacki 269

Oxide Coatings on Tin—No. 2,771,410, November 20, 1956—J. Russel and H. Headland (Pat. Abs.) 188

Phosphate Coatings, The Effect of the Chromic Acid Rinse on, J. Doss, W. Dennis McHenry and S. L. Eisler (Art. Ref.) 414

Phosphating Bath, The Modern Chlorate-Accelerated (Art. Ref.) 805

Plated Coatings, Accelerated Corrosion Tests for the Performance of (Fourth Progress Report), W. L. Pinner 763

Plating Baths, Dissolved Gases in, W. M. Tucker and F. O. Beuckman, George B. Hogaboom Memorial Award—44th Annual Convention 783

Plating Copper Particles with Silver—No. 2,771,380, November 20, 1956—J. Coleman and E. Dittman 188

Plating, Method of—No. 2,766,194, October 9, 1956—A. Certa (Pat. Abs.) 188

Platinum, Electrodeposition of—No. 2,792,341, 5/14/57—R. Atkinson (Pat. Abs.) 1210

Plutonium, Electrodeposition of, F. L. Moore and G. W. Smith (Art. Ref.) 699

Plutonium Fluoride, Electrodeposition of—No. 2,758,963, August 14, 1956—M. Kahn (Pat. Abs.) 300

Rhodium in Co-Axial Radio-Frequency Circuits, Electrodeposited, D. O. Walter (Art. Ref.) 414

Silver, Bath for Electroplating—No. 2,777,810, 1/15/57—B. Ostrow (Pat. Abs.) 912

Sodate-Containing Plating Baths—No. 2,783,194, February 26, 1957—F. Nobel and B. Ostrow (Pat. Abs.) 1005

Tin

Electrolytic Tin Plating of Steel Sheet from Chloride Solutions, V. P. Kochergin, T. A. Nimitskaya and M. Ya (Art. Ref.) 72

Electrodeposition of Tin—No. 2,758,075, August 7, 1956—D. Swalheim (Pat. Abs.) 298

Electrolytic Tin-Plating of Steel Sheet from Chloride Solutions, V. P. Kochergin, T. A. Nimvitskaya and M. Ya (Art. Ref.) 72

Marked Electrolytic Tinplate—No. 2,770,872, November 20, 1956—A. Kadell (Pat. Abs.) 188

Tin Plating from the Pyrophosphate Bath, J. Vaid and T. L. Rama Char (Art. Ref.) 1029

Titanium Coatings from Fused Salt Baths, Mechanism of Deposition of, M. E. Straumanis, S. T. Shih and A. W. Schlechten (Art. Ref.) 412

Titanium, Electrodeposition of, Part 3, E. W. Reid Jr., J. H. Connor and A. Brenner (Art. Ref.) 1030

Titanium on Base Metals, Electrodeposition of, M. E. Sibert (Art. Ref.) 1329

Titanium, Plating—No. 2,798,843, 7/9/57—G. Slomin and M. Christensen (Pat. Abs.) 1315

Tungsten, Electroplating with—No. 2,794,775, 6/4/57—W. Buckingham (Pat. Abs.) 1211

Tungsten, Plating of, by an Oxidation-Reduction Cycle, M. G. Charlton and G. L. Davis (Art. Ref.) 309

Uranium, Electrodeposition of—No. 2,781,304, February 12, 1957—H. Wilhelm and D. Ahamann (Pat. Abs.) 1002

Uranium Oxide, Electrodeposition of—No. 2,784,486, March 12, 1957—A. Langer and C. Wilson (Pat. Abs.) 1006

Vital Role of Plating and Pickling Techniques in the Aircraft Industry, The, S. A. Long 1183

Zinc, Electroplating—No. 2,791,554, 5/7/57—J. Winters (Pat. Abs.) 1206

Zinc Electroplating—No. 2,799,635, 7/16/57—A. Chester and R. Main (Pat. Abs.) 1316

Zirconium, Deposition of—No. 2,796,392, 6/18/57—M. Lietzke (Pat. Abs.) 1314

Plating Plant Layout, Prize Winning Entries in the Institute of Metal Finishing Competition (Art. Ref.) 1126

Polarization and Overvoltage, Project No. 8, AES Research, R. A. Schaefer 497

Page

Polarographic Analysis of Tin and Tin Alloy Plating Solutions, A. E. Knutowicz and J. V. Petrocelli ... 602
Polyvinyl Chloride Pipe Handles Corrosive Plating Solutions, T. F. Long ... 975
Pope, J. A.
Electroforming of Linear Accelerator Structures ... 1291
Biography ... 1296
Porosity of Electrodeposited Metals, Project No. 6, AES Research, N. Thon ... 495
Porosity of Electroplated Chromium Coatings, The (Concluded 1931), Summaries of AES Completed Research Projects, W. Blum, W. P. Barrows, A. Brenner (Associates) (National Bureau of Standards) ... 768
Powdered Metal Deposition—No. 2,786,779, March 26, 1957—A. Long, et. al. (Pat. Abs.) ... 1102
Practical Aspects of Aluminum Hardcoating, A. W. Sweet ... 1191
Precious Metal Plating Award, Gold-Silver Alloy Plating, Dr. R. E. Harr and A. G. Cafferty, Honored at the Society's 44th Annual Convention ... 783
Precision Parts, Mechanical Finishing of, L. H. Hopewell, The Robert S. Leather Award—44th Annual Convention ... 783
Preparation for Electroplating with Coated Abrasives, W. K. Seward ... 43
Preparation of Protective Coatings by Electrophoretic Methods, A. C. Werner (Books) ... 1339
Preservation of Stored War Material, J. L. McCloud (Art. Ref.) ... 194
Principles of Laboratory Temperature Control, Electronic Relays, Thermistor Operated Control, C. M. Proctor (Books) ... 378
Printed Circuit, Forming—No. 2,777,192, January 15, 1957—R. Albright and H. Golden (Pat. Abs.) ... 790
Printed Circuits—No. 2,758,074, August 7, 1956—O. Black and R. Walsh (Pat. Abs.) ... 188
Printed Circuits and the Electroplating Industry, H. Shapiro ... 607
Printing Plate—No. 2,791,952, 5/7/57—G. Vasel (Pat. Abs.) ... 1206
Prizewinning Plating Plant Layouts, Competition Held by England's Institute of Metal Finishing ... 1086
Process and Apparatus for Simultaneously Drawing and Plating Wire—No. 2,762,763, September 11, 1956—H. Kenmore and W. Musson (Pat. Abs.) ... 304
Process for Producing Steel-Aluminum Bi-Metal Strip—No. 2,863,958, September 18, 1956—W. McCullough and W. Wyatt (Pat. Abs.) ... 404
Process for the Production of a Wrinkle Finish—No. 2,776,225, January 1, 1957—J. Fletcher (Pat. Abs.) ... 789
Process for Treating Metallic Strip—No. 2,797,476, 7/2/57—T. Sendzimer (Pat. Abs.) ... 1314
Processing Separable Fastener Stringers—No. 2,799,636, 7/16/57—R. MacLachan (Pat. Abs.) ... 1316
Producing Steel by Electroforming and Carburization—No. 2,758,950, August 14, 1956—J. Lakner (Pat. Abs.) ... 300
Production of Smooth, Fine-Grained Electrodeposits. Some Theoretical Aspects and Principles, G. Gabrielson (Art. Ref.) ... 72
Program of Events, Montreal Convention ... 518
Progress Report—Fourth, Accelerated Corrosion Tests for the Performance of Plated Coatings, W. L. Pinner ... 763
Proposed Tentative Recommended Practice for Preparation of Lead and Lead Alloys for Electroplating, ASTM Designation: B-57T ... 1104
Protecting Hot Extruded Metal—No. 2,762,115, September 11, 1956—N. Gates (Pat. Abs.) ... 302
Protecting Metal Surfaces—No. 2,785,091, March 12, 1957—C. Rex (Pat. Abs.) ... 1100
Protecting Molybdenum and Tungsten at High Temperatures—No. 2,772,227, November 27, 1956—M. Quaely and W. Lilliendahl (Pat. Abs.) ... 402
Protective Value of Nickel and Chromium Plating on Steel (Concluded 1934), Summaries of Completed AES Projects, W. Blum, P. W. Strausser, A. Brenner ... 768

R

Rarick, R. K. (Finance), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Read, Harold J.
Methods for Testing Thickness of Electrodeposits, Project No. 7, AES Research ... 496
Recover That Plating Waste, E. W. Neben (Art. Ref.) ... 72
Recovering Non-Ferrous Alloys from Ferrous Materials—No. 2,796,394, 6/18/57—R. Schaefer and G. Kingsbury (Pat. Abs.) ... 1314
Recovering Precious Metals—No. 2,797,194, 6/18/57—R. Anderson and R. Haw (Pat. Abs.) ... 1314
Reisenburg, J. T. Jr., Printing Committee, Montreal Convention ... 408, 651
Reisenburg, J. T. Sr., Publicity Committee, Montreal Convention ... 408, 651

Page

Relief of Residual Grinding Stresses by Annealing, H. R. Letner and A. B. Sauvageot (Art. Ref.) ... 1226
Research and Development on Electrodeposition of New Chromium and Chromium-Alloy Plate, L. D. McGraw (Books) ... 1339
Research Projects, Summaries of Completed AES ... 767
Rhenium, Coating a Carbonaceous Surface with—No. 2,778,786, January 22, 1957—H. Perlman, et. al. (Pat. Abs.) ... 912
Robert S. Leather Award, The, Mechanical Finishing of Precision Parts, L. H. Hopewell, Honored at the Society's 44th Annual Convention ... 783
Roof, E. (Registration), Branch Leadership of the 45th Annual Convention ... 1095, 1309
Rubber Bonding Process—No. 2,776,254, January 1, 1957—S. Bart (Pat. Abs.) ... 789
Rust Inhibitors to Meet Service Requirements, Selection of, A. J. Freedman, A. Dravnieks, W. B. Hirschmann and R. S. Cheney (Art. Ref.) ... 412
Rust Proofing Steel—No. 2,800,422, 7/23/57—A. Piccinelli (Pat. Abs.) ... 1317

S

Safety in Metal Finishing, L. E. Weeg ... 510
Safranek, W. H. and G. R. Schaer, Properties of Electrodeposits at Elevated Temperatures, AES Bronze Medal Award—44th Annual Convention ... 783
Safranek, W. H., Surface Treatment of Low Alloy Steel by Sam Tour (Review) ... 825
Salt Spray Test and Its Modifications (Accelerated Testing of Metallic Surfaces), W. D. McMaster (Art. Ref.) ... 72
Sample, C. H., Summaries of Projects 10, 12 and 13, AES Research ... 506
Saubestre, Dr. E. B., Summary, Semi-Annual Meeting, Committee B-8, American Society of Testing Materials, October 17-18, 1957, Hotel Benjamin Franklin, Philadelphia, Pa. ... 1318
Saur, R. L.
Nondestructive Thickness Measurement of Anodizing Using the Interference Microscope ... 1079
Biography ... 1082
Schaefer, C. B. and R. G. Messenger, Barrel Finishing with Steel Balls and Shapes ... 40
Schaefer, C. B., Biography ... 42
Schaefer, R. A.
Polarization and Overvoltage, Project No. 8, AES Research ... 497
Chairman, Sixth Session, Montreal Convention ... 519, 649
Schaefer, Dr. R., Publications Committee Chairmen of 1957-1958 AES Boards and Committees ... 985
Schaer, G. R. and W. H. Safranek, Properties of Electrodeposits at Elevated Temperatures, AES Bronze Medal Award—44th Annual Convention ... 783
Science for Electroplaters—Chemical Service Preparation, L. Serota (Art. Ref.) ... 692, 805
Science for Electroplaters—Throwing Power, L. Serota (Art. Ref.) ... 412
Selecting and Testing Finishing Materials, H. P. Wertman ... 279
Selecting Electroplates for Iron Powder Parts, W. H. Safranek and M. W. Wirth (Art. Ref.) ... 194
Selenium Elements, Manufacture of—No. 2,766,210, October 9, 1956—F. Koury and B. Hecht (Pat. Abs.) ... 514
Serfass, Dr. E. J., Candidates for National Third vice-President ... 426
Serfass, E. J., Determination of Impurities in Electroplating Solutions; Major Constituents; Cyanides in Plating Wastes, Project No. 2, AES Research ... 504
Seward, W. K.
Preparation for Electroplating with Coated Abrasives ... 43
Biography ... 46
Shapiro, H.
Printed Circuits and the Electroplating Industry ... 607
Biography ... 611
Shot Blasting and Shot Peening of Light Alloys, F. Flusin (Art. Ref.) ... 412
Should Job Shop Platers Automate? Julian Nelkin (Art. Ref.) ... 804
Silicon, Electrical Contacts to—No. 2,793,420, 5/28/57—R. Johnston and R. Bulison (Pat. Abs.) ... 1208
Silver Layers, Method of Providing—No. 2,776,915, January 8, 1957—G. van Oosterhaut and A. Bol (Pat. Abs.) ... 789
Silver in Chemical Plant Construction, J. M. Pirie (Art. Ref.) ... 690
Silver Plating for Engineering Purposes (Art. Ref.) ... 1329
Smith, A. J., The Effect of Impurities in Nickel Plating Solutions, Project No. 5, AES Research ... 501
Smith, A. J. and R. Bacon, AES Research Project 5, Effects of Impurities and Purification of Electroplating Solutions. I. Nickel Solutions. II. The Effect and Removal of Calcium ... 186
Soldering Flux—No. 2,788,303, April 9, 1957—R. Ballard and D. Burch (Pat. Abs.) ... 1127

Page

Soldering the "I possible," C. F. Gurnham (Art. Ref.) ... 1028
Solvent Extraction in Analytic Chemistry, G. H. Morrison and H. Freiser (Books) ... 1117
Special Reports on Finishing Non-Ferrous Metals, Number III—Lustrous, Corrosion-Resistant Finishing with Chemical Polishing Iridite ... 1154
Spectrophotometric Determination of Nickel in Bright Cadmium and Bright Gold Plating Solutions, N. F. Doherty ... 971
Spotting of Plated or Finished Metals, The, AES Research, W. P. Barrows ... 493
Spray Painting with Compressed Air Atomization, A. A. Harvey (Art. Ref.) ... 1329
Stabile, T., Convention Chairman Los Angeles, 1960, Convention and Exposition Chairmen and Co-Chairmen ... 985
Standard Salt-Spray Test—Is It A Valid Acceptance Test? A. Mendizza ... 166
Statistical Table for Duplicate Results, A Technique Useful in Sampling Problems and Vendor-Consignee Disagreements, W. J. Youden (Art. Ref.) ... 1029
"Statistics" and the Coatings Chemist, H. B. Wagner (Art. Ref.) ... 1029
"Steam-Spraying" Expands the Paint Dollar, H. B. Wagner (Art. Ref.) ... 1226
Steel
Activation and Passivation of Stainless Steel in Aerated Sulfuric Acid, The, G. H. Cartledge (Art. Ref.) ... 1028
Process for Hardening Steel—No. 2,778,756, January 22, 1957—N. Breedzs (Pat. Abs.) ... 912
Process for Treating Steel—No. 2,759,886, August 21, 1956—H. Priest (Pat. Abs.) ... 300
Stephenson, W. B. Jr. (Educational) Branch Leadership of the 45th Annual Convention ... 1095, 1309
Stop Chrome Waste, Pollution and Heat Loss, E. W. Neben ... 52
Strausser, P. W., W. Blum, Outdoor Exposure Tests of Electroplated Nickel and Chromium Coatings on Steel and Non-ferrous Metals, Summaries of Completed AES Research Projects ... 770
Strausser, P. W., W. Blum, A. Brenner
Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel, Summaries of Completed AES Research Projects ... 769
Protective Value of Nickel and Chromium Plating on Steel, Summaries of Completed AES Projects ... 768
Stress Corrosion Cracking and Embrittlement (Books) ... 378
Stress in Electrodeposits, R. Pinner (Art. Ref.) ... 414
Stripping of Copper From Various Base Metals, Project No. 1, AES Research, F. C. Mathers ... 493
Stroh, J. and C. Allen
Low-Cost Integrated Waste Treatment at American Sterilizer ... 869
Biography ... 872
Studies on Electroless Nickel Plating, A. Brenner and C. H. de Minjer ... 1297
Study of Cadmium-Tin and Zinc-Tin Alloy Electrodeposits, B. Cohen ... 963
Study of the Cathodic Reduction of Oxide Films on Iron. I. Reduction of Alpha-Fe_2O_3 Films, H. G. Oswin and M. Cohen (Art. Ref.) ... 414
Study of the Deformed Layer Produced on Metal Surfaces by Mechanical Machining, Abrasion and Polishing Operations, L. E. Samuels (Art. Ref.) ... 1328
Study of the Feasibility of Coating Magnesium with High-Purity Aluminum, C. F. Powell and I. E. Campbell (Books) ... 853
Summaries of Completed AES Research Projects ... 767
Summaries of Projects 10, 12 and 13, C. H. Sample, District Supervisor, AES Research ... 506
Summary (Over-All), Projects 5, 14 and 15, C. F. Nixon, District Supervisor, AES Research ... 499
Summary (Over-All), Projects 2, 16 and 17, F. A. Lowenheim, District Supervisor, AES Research ... 503
Surface Treatment and Finishing of Light Metals—Organic Finishing of Aluminum, S. Wernick and R. Pinner (Art. Ref.) ... 1227
Surface Treatment and Finishing of Light Metals, Part XII-E—Plating on Aluminum—Hard Chromium and Non-Electrolytic Deposits, S. Wernick and R. Pinner (Art. Ref.) ... 804
Surface Treatment of Titanium (French), H. Richaud (Art. Ref.) ... 1030
Surface Treatments of Low Alloy Steel, Sam Tour (Books) ... 852
Survey of Paint Application Methods, A. Part 1: Use of the Spray Gun, E. A. Blount (Art. Ref.) ... 692
Swift, Dr. G. P., Proposed Changes in the AES Constitution ... 486
Sweet, A. W.
Practical Aspects of Aluminum Hardcoating ... 1191
Biography ... 1196
Symposium on Properties, Tests and Performance of Electrodeposited Metallic Coatings (Books) ... 398

Page

Symposium on pH Measurement—ASTM Special Technical Publication 190 (Books) 852
Synthetic Dead Metal—No. 2,793,177, 5/28/57—W. Fourier (Pat. Abs.) 1208

T

Tentative Approach to Cost Control in Electroplating, J. M. Alameda (Art. Ref.) 1125
That Cincinnati Branch, Your 1958 Convention Host 1202
This Message to You at Christmastime, J. P. Nichols (Editorial) 1263
Thon, N., Porosity of Electrodeposited Metals, Project No. 6, AES Research 495
Three Low-Cost Ways to Mark Metals Permanently, R. A. Botosan (Art. Ref.) 1328
Throwing Index—A New Graphical Method for Expressing Results of Throwing Power Measurements (Art. Ref.) 804
Time Table in the Courtship of Knowledge (Editorial) 7
Tinplate Handbook, W. E. Hoare (Books) 378
Tinplate, Treatment of—No. 2,775,535, Dec. 25, 1956—W. Poole (Pat. Abs.) 668
Tirendi, F., Public Relations Committee, Chairmen of 1957–1958 AES Boards and Committees 985
Titanium
Descaling Titanium Sheet, W. J. Barth (Art. Ref.) 412
Metallic Titanium—No. 2,780,593, February 5, 1957—G. Snow and A. A. McCord 1091
Method for Treating Titanium—No. 2,779,727, January 29, 1957—G. Couch and W. Moor (Pat. Abs.) 1000
Production of Titanium—No. 2,786,808, March 26, 1957—R. Raney (Pat. Abs.) 1102
Production of Titanium—No. 2,789,943, April 23, 1957—W. Kittelberger (Pat. Abs.) 1127
Surface Treatment of Titanium, H. Richand (Art. Ref.) 414
Titanium Descaling Process—No. 2,790,738, 4/30/57—H. Alexander and H. Farrell (Pat. Abs.) 1232
Titanium Electrolyte—No. 2,798,844, 7/9/57—M. Freedman (Pat. Abs.) 1315
Treatment of Metal Surfaces—No. 2,787,565, April 2, 1957—E. dePretto (Pat. Abs.) 1102
Tucker, W. M., Article References 72, 194, 308, 412, 690, 804, 906, 1028, 1125, 1226, 1328
Tucker, W. M. and F. O. Beuckman, Dissolved Gases in Plating Baths, George B. Hogaboom Memorial Award—44th Annual Convention 783
Two-Step Process Retards White Rust, L. J. Brown (Art. Ref.) 72
Two Tanks Do Work of Ten in Surface Treatment, C. J. Riddle (Art. Ref.) 1226

U

Uranium
Continuous Process for Reducing Uranium in Solution—No. 2,775,552, Dec. 25, 1956—R. Boyer (Pat. Abs.) 668
Electrodeposition of Uranium—No. 2,781,304, February 12, 1957—H. Wilhelm and D. Ahmann (Pat. Abs.) 1002
Preparation of Uranium—No. 2,777,809, January 15, 1957—M. Kolodney (Pat. Abs.) 790
Recovery of Uranium by Electrolysis of Fused Bath—No. 2,774,729, Dec. 18, 1956—G. Meister (Pat. Abs.) 668
Ultrasonics
Applications of Ultrasonics in Surface Treatment of Metals. Cleaning by Means of Piezo-oscillations, P. Wenk (Art. Ref.) 194
Application of Ultrasonics in the Electroplating Industry, Dr. T. J. Bulat (Art. Ref.) 1126
Cleaning by Ultrasonics, J. Lomas (Art. Ref.) 412
Cleaning with Ultrasonic Devices, A. Graul (Art. Ref.) 194
Effects of Ultrasonics on the Electrolytic Deposition of Metals, The (Art. Ref.) 1227
Problems of Ultrasonic Application in Surface Treatment of Metals, K. Frolich (Art. Ref.) 194

V

Vapor Blasting, Facts About, H. F. Patin (Art. Ref.) 412
Vapor Stripping of Stop-off Coatings, E. R. Jorczyk (Art. Ref.) 1328
Vigor of Youth, The, T. Eddy (Editorial) 831
Vital Role of Plating and Pickling Techniques in the Aircraft Industry, The, S. A. Long 1183
Voyda, T., Meet Mr. President, Waterbury Branch 66

W

Water . . . A Global Problem for Electroplaters, D. Milne and Dr. D. G. Foulke 859
Waters, A. R. (Banquet), Branch Leadership of the 45th Annual Convention 1095, 1309
Waveguide Structure—No. 2,793,989, 5/28/57—R. Goodman et al (Pat. Abs.) 1210
Weng, L., Safety in Metal Finishing 510
Wertman, H. P.
Selecting and Testing Finishing Materials 279
Biography 280
Wesley, W. A.
Breaking Barriers (Editorial) 1147
Third Vice President, AES, 1957–1958 National Officers 777
Candidates for National Third Vice President 426
Chairmen of 1957–1958 Branch Exhibits Committee 985
West, A., Chairman, Third Session, Montreal Convention 518, 649
Wettstein, Bob, AES Western Advertising Representative 652
What Constitutes a State? J. P. Nichols (Editorial) 739
What we Expect of Finishes for the Automotive Industry, R. J. Wirshing (Art. Ref.) 414
"Who's Who" of Cincinnati's Fine Restaurants, A 1203
Why Centerless Brushing Finishes Faster, R. C. Sasena (Art. Ref.) 412
Wilson, W., Convention Chairman Detroit 1959, Convention and Exposition Chairmen and Co-Chairmen 985
Winterman, R. (Program), Branch Leadership of the 45th Annual Convention 1095, 1309
Wise, C., Chairman, Branch Leadership of the 45th Annual Convention 1095, 1309
Wise, C., Cincinnati Convention, Chairman of 1957–1958 AES Boards and Committees 985
Wrisberg, A. P., Financing AES Research 490
Wysong, R. D.
AES and Organic Coatings, The (Editorial) 231
Blueprint for Your Society's Further Growth (Editorial) 1047
Chairmen of 1957–1958 Membership Committee 985
Third Vice President, AES, 1957–1958 National Officers 777
Third Vice President's Report 628

Y

Young, J. P. and V. A. Lamb, Chromium Plating of Gun Bores, Chromium Plating Award—44th Annual Convention 783
Young, Mrs. W. (Ladies), Branch Leadership of the 45th Annual Convention 1309

Z

Zinc
Composition for Coating Zinc—No. 2,799,601, 7/16/57—H. Hartman (Pat. Abs.) 1316
Sprayed Aluminum and Zinc in Corrosive Environments, R. E. Mansford (Art. Ref.) 72
Preparation of Zinc Electrolytes—No. 2,772,230, November 27, 1956—M. Hollander and Y. Lebedeff (Pat. Abs.) 402
Treating Zinc Ferrous Surfaces—No. 2,786,002, March 19, 1957—L. Van and A. Douty (Pat. Abs.) 1101
Zinc Cyanide Electrolyte—No. 2,757,134, July 31, 1956—D. Turner (Pat. Abs.) 188
Zinc Electroplating—No. 2,799,635, 7/16/57—A. Chester and R. Main (Pat. Abs.) 1316
Zirconium, Deposition of—No. 2,796,392, 6/18/57—M. Lietzke (Pat. Abs.) 1314

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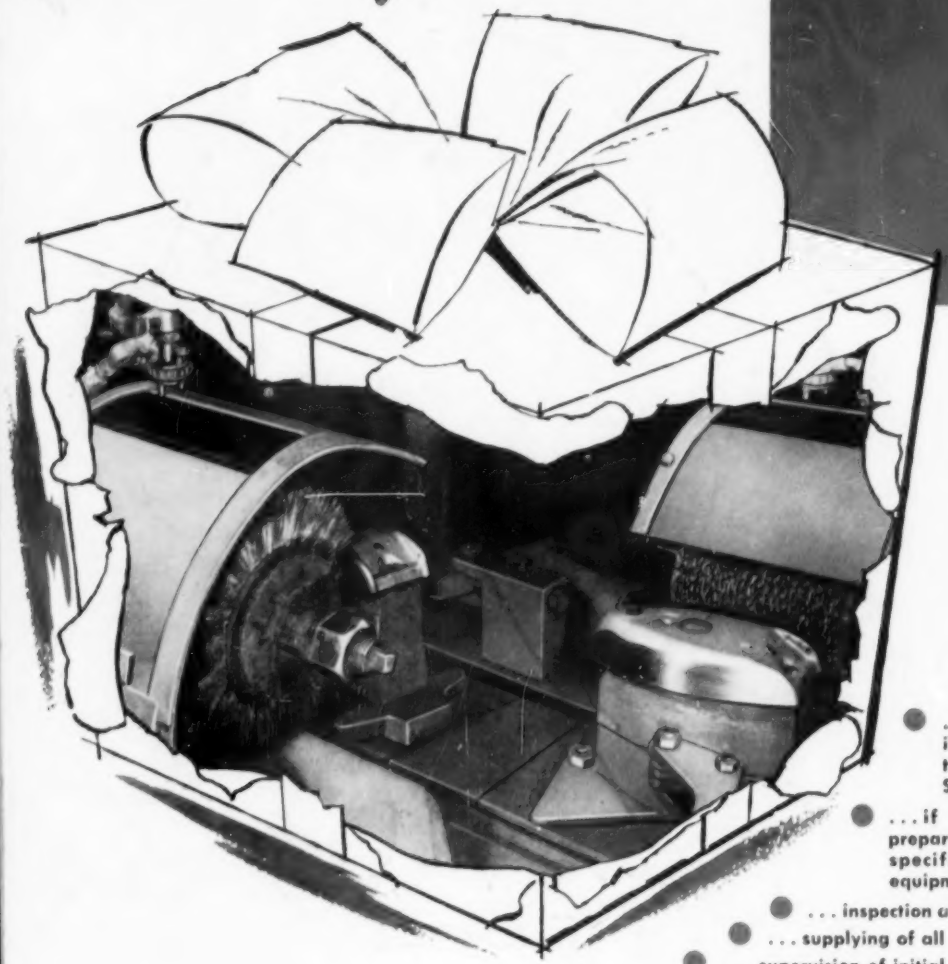

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- **... supervision of initial operations.**

Lea Continuous Spray Buffing, utilizing one or more grades of the well known LEA LIQUABRADE, has so well proved itself in a number of plants that every company, particularly those with 'production lines', should consider changing over from bar to liquid. The Lea Technical Service outlined above is available for such a study. The point to keep in mind here is that you are getting the service of Finishing Specialists who not only have been associated with metal polishing and buffing from the early twenties but actually improved upon liquid buffing materials and liquid buffing methods.

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing... Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions. Manufacturers of Lea Compound and Learok ... Industry's quality buffing and polishing compounds for over 30 years.

LEA®

The Hallmark of Quality Products

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